Commercial Fisheries Abstracts

a monthly summary of important developments for the fishery industries

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Commercial Fisheries Abstracts

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Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget November 23, 1956.

0.33 THE INTERACTION OF SUGARS AND PROTEINACEOUS SUBSTANCES OF OLEAGINOUS SEEDS IN THE PROCESS OF OIL MILLING

Rjechin, V. P.
Masloboino-Jirovaya Promyshlennost 22, 3-6 (1956)
Translated and abstracted by Horvath, A. A. (Santa Fe, New Mexico)
Journal of the American Oil Chemists' Society 34, 8 (July 1957)

The author studied the formation of melanoidine compounds under laboratory as well as actual production conditions.

When mixtures of glucose and lysine (1:1) were being heated in the solid state for two hours, the melanoidine formation proceeded slowly at temperatures up to 105° C., but above it the rate of the reaction was greatly increased. At a temperature of 125° C. a substantial liberation of CO_2 was observed, accompanied by a 24% loss in weight of the glucose. Also there accumulated 41% (of the weight of the initial lysine) of water-insoluble, dark brown, almost black reaction-products, which were poorly soluble even in concentrated solutions of alkalies and acids. Similar data were obtained while heating powdered mixtures of glucose with glycine.

Ground soybeans, heated under analogous conditions, showed no essential changes up to a temperature of 105° C., but at 115° C. the loss in dry matter amounted to 0.72% and the content of water-soluble, dry substances was lowered by 32%. Experiments with defatted and degossypolized, ground cottonseed, heated under constant moisture conditions in sealed test tubes, confirmed the formation of gaseous reaction products as well as of melanoidines. It was also found that the interaction of proteinaceous substances with sugars is greatly accelerated above 105° C. and that within the range of 105° to 130° C. the rate of sugar binding approximately doubles with each 10° rise in temperature.

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0.34 INCLUSION COMPOUNDS

Baron, Maximo
Organic Chemical Bulletin 29, 1-5 (1957) Eastman Organic Chemicals Department, Distillation Products Industries, Division of Eastman Kodak Company, Rochester 3, New York

Definition.--Inclusion compounds arise from the ability of one compound spatially to enclose another. The enclosed or "guest" compound is in a situation whereby it cannot readily leave its position, although it is not actually bonded to the including or "host" compound. The essential property of the host compound is its ability to form a solid structure containing hollow spaces (some will not do it when pure) within which the prospective guest compound can fit. The resulting "inclusion compound" will then be stable, because any deficiency in actual bonding energy will be compensated for by the effect of close spatial fitting.

Inclusion compounds can be classified as follows:

1. Polymolecular inclusion compounds.
   a. Those with channel-like spaces.
   b. Those with cage-like spaces (the clathrates).
2. Monomolecular inclusion compounds.
3. Macromolecular inclusion compounds.
4. Products of the blue iodine reaction.

(over)

 ABSTRACTER: Edward H. Gruger, Jr.

0.38 THE ACTION OF FISH TISSUE ON THIAMIN

Kupstas, Edward E. and Hennessy, Douglas J. (Department of Chemistry, Fordham University, New York City)
Journal of the American Chemical Society 79, 5217-5225 (October 1957)

III. The further elucidation of the structure of icthiamin.--Chromatographic studies show that hypotaurine (2-aminoethanesulfinic acid) is formed in the reaction of icthiamin with hydroxide and with bisulfite in the presence of hydroquinone. Exhaustive drying indicates that icthiamin dihydrobromide is a monohydrate. These facts, together with the infrared absorption characteristic of the sulfone group and earlier information, suggest that icthiamin is a 4-amino-5-(2-aminoethanesulfonyl)-methyl-2-methylpyrimidine.

IV. The synthesis of icthiamin.--Icthiamin was synthesized by condensing 4-amino-5-bromomethyl-2-methylpyrimidine hydrobromide with 2-phthalimidoethanesulfinic acid, followed by hydrazinolysis of the phthaloyl group. The identity of synthetic phthalylicthiamin and icthiamin dehydrobromide with the corresponding compounds prepared from natural icthiamin was shown by chromotographic, infrared, and elementary analyses.

V. Studies on the biosynthesis of icthiamin.--Four possible naturally occurring precursors of the characteristic aliphatic side chain of icthiamin, viz., cysteine, 2-amino-ethyl mercaptan, cysteinesulfinic acid, and hypotaurine, were shown to inactivate thiamin in the presence of dialyzed clam extract. Chromatographic analysis of the resulting products and of the products of their reaction with bisulfite showed that only hypotaurine reacted to form icthiamin in significant amounts under these conditions.

 ABSTRACTER: Martin Heerdt

1.81 BODY FLUID LOSSES OF NORTHERN AND SOUTHERN OYSTERS

Fingerman, Milton; Fairbanks, Laurence D.; and Plauche, Warren C. (Tulane University, New Orleans 18, Louisiana)
Commercial Fisheries Review 19, 16-18 (September 1957)

This report summarizes experiments on the loss of body fluid by Northern and Southern oysters shucked in the spring and in the fall of 1956.

Experimental.--Oysters were obtained from Barataria Bay (Louisiana), Chesapeake Bay, and Delaware Bay during the months of March and April and of October and November, 1956. Each experiment was performed as follows: Bodies of 19 oysters were removed from their shells and placed in individual containers. Initial body weight, including the fluid escaping through ruptures in the mantle, was determined. The bodies, without the fluid that escaped, then were weighed at intervals.

Results.--Data on weight changes are given in table 1 (see over). In the spring, practically no differences in shrinkage were found between Northern and Southern oysters. In the fall, however, Louisiana oysters lost considerable more weight than did Chesapeake oysters, and Chesapeake oysters lost considerably more weight than did Delaware oysters.

The composition of body fluid is not the same in all parts of the oyster. The most cells, for example, were found in blood taken directly from the heart(1715 per cubic milliliter), and the fewest in the pericardial fluid (348 per cubic milliliter). Cells comprised less than 0.1 percent of the volume of body fluid. Some correlation between concentration of chloride and of proteinaceous material was evident. Oysters with the greatest concentration of proteinaceous material tended to have the highest

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 ABSTRACTER: F. Bruce Sanford

SUGAR-PROTEIN REACTION

CHEMICAL INCLUSION COMPOUNDS

ACTION OF FISH ON THIAMIN

FLUID LOSSES IN OYSTERS

0.34

Polymolecular inclusion compounds.--In the compounds with channel-like spaces, the host (urea, thiourea, desoxycholic acid) can accommodate any of a variety of guests. When, in the presence of a suitable guest, a host compound is allowed to crystallize, it will come out in a lattice containing roughly cylindrical channels of a specific diameter, the nature of the guest molecule being varied only insofar as it will not have a cross section incompatible with the diameter mentioned. The framework of the pure host differs from that in the adduct, thus making it impossible to determine in advance whether or not it will form such adducts. In this type of inclusion compound, there is no simple molar ratio of host to guest.

Urea adducts are formed by simply mixing urea with the long-chain component; this can be done in solid form or by using some suitable solvent (chloroform or methanol). The minimum requirements in chain length are given in table 1.

Table 1.--Urea adducts

Guest compounds	Lowest useful member
Hydrocarbons	n-Hexane
Alcohols	Hexanol
Ketones	Acetone
Acids	Butyric
Halides	Octyl
Amines	Hexamethylenediamine

These adducts can be decomposed by heat or by solvents. Unsaturated fatty acids become stabilized to oxidation by being protected from external influences within the channels of the adduct.

Thiourea adducts, generally speaking, are similar to those of urea. The main difference is that the channels in the crystalline structure of the thiourea adducts have larger diameters. As a result, normal hydrocarbon chains are too slender to promote adduct formation; whereas, the more bulky compounds, such as branched-chain hydrocarbons, take the place held by the n-paraffins in the urea adducts.

Other adducts are formed using desoxycholic acid and 4,4'-dinitrobiphenyl. Guest compounds such as cholesterol, xylene, and camphor will form adducts with desoxycholic acid. Similarly, nucleophilic compounds such as 4,4'-dimethoxybiphenyl are guest compounds for adducts of 4,4'-dinitrobiphenyl.

0.33 (Cross Reference: 8.59)

The loss of detectable sugar at 115° C. was approximately one-third of the original amount present. Experiments with soybeans and cottonseed under plant conditions showed that the higher the temperature of the meal, the more intensive is the interaction between sugars and proteinaceous substances. In soybeans, at a temperature of 102° C. the sugar content went down 7.2% of its original value, and at 115° C. 22%.

The author was able to show that the formation of melanoidines takes place also during storage of the press cake, especially under conditions promoting spontaneous heating, where the amount of sugars dropped 86% while the amount of nitrogen in the residue, insoluble in 0.2% NaOH, increased four-fold. Simultaneously an increase in the percentage of total nitrogen was noted in the cake, evidently on account of the losses of dry matter, because of the reaction of melanoidine formation, with the evolution of CO_2. The author calls attention to the importance of keeping an eye on the rate and extent of the interaction between sugars and proteinaceous substances in selecting the proper conditions for the processing of oleaginous seeds.

1.81

concentration of chloride.

This study was conducted under a contract between Tulane University and the United States Fish and Wildlife Service. Funds were made available under the Saltonstall-Kennedy Act.

Table 1.--Relation between geographical source, season, and body weight of oysters 60 minutes after shucking.

Geographical source	Body weight 60 minutes after shucking	
	In the spring	In the fall
	Percentage of original	Percentage of original
Delaware Bay	54.4	57.1
Chesapeake Bay	51.3	40.8
Louisiana	53.5	30.5

0.38

2.119 USE OF STAKE-TYPE BOAT ANCHORS IN WING-NET FISHING

Hansen, Donald F. (Illinois Natural History Survey, Urbana)
Progressive Fish-Culturist 19, 142-143 (July 1957)

Anyone who has fished wing nets for any great length of time has probably seen the need for a method that would allow the nets to be lifted and reset by one man instead of the usual two. Some-time ago I worked out a method which not only is good for one-man use under various wind conditions but also permits a distinct saving of labor for the two-man crew when winds are strong.

In the traditional net-lifting operation, the drift of the boat during the steps of lifting and empty-ing causes the pot of the net to be pulled out of alignment with the wings. To reset the net with pot and wings in the proper alignment, it is customary for one man to pull on the oars while the other pulls on the tail pole (which is tied to the pot by a long cord). Often net-lifting operations are suspend-ed in windy weather because of the labor involved in pulling the nets back into position for resetting.

The essential feature of the new method is that the successive steps of lifting, emptying, and resetting the net are all carried on from a boat that is anchored in one fixed position. The anchors are two long metal stakes which pass through open-end sockets mounted vertically at each end of the fishing boat (figures 1a and 1b). As the stake-type anchors effectively prevent drift of the boat while the net is being emptied, the usual difficulties of realigning and resetting the net are avoided.

In order that the net operator may be able to reach the tail pole as well as the net hoops from the anchored boat, it will generally be found necessary to reduce the length of the tail cord. The tail cord on the net in figure 1b was shortened from its original length of about 10 feet to about 3 feet.

The stake-type anchors described here have, until now, been used in lake netting operations at

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2.147 TRAWL-SEINE BOAT WOULD SOLVE 'IDLE TIME' PROBLEM

Anonymous
Southern Fisherman 17, 75, 128 (August 1957)

In the fishing business it is said that "you can't make money laying to the dock." Therefore, if you can fish six months and lie idle six months and still make money, you are in a fortunate position. This is precisely what most of the Southern menhaden boats do each year. Since they generally break even, moreover, it can be said that they are, at present, very fortunate.

Time, economics, and other factors, however, are working to change this picture, and in the near future it may not be possible to be idle half the year and still break even. Competition from other products may weaken the price of fish meal and oil. Growing demand for labor in the South may create an even greater scarcity of skilled fishermen, and the rising cost of everything may even-tually force high-cost operations out of business.

The shrimp fleet fishes almost all the year. If just 20 percent of the shrimp fleet left shrimp-ing each year for three or four months to fish for menhaden, the effect on the price of shrimp, the cleaning up of frozen stocks, and the quickening of demand would have a very good effect on the market. At times, in 1954 for example, half the shrimp fleet would have gone to other types of fish-ing if they had just known how.

The solution may be the combination boat--a shrimp trawler that quickly can switch to menhaden, when this type of fishing is more profitable than shrimping. The ability to switch quickly and easily is the main design feature, and as far as shrimp trawlers are concerned, this was not possible until a few years ago when the powerblock was developed on the West Coast. As an example, last year at

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ABSTRACTER: Kathryn L. Osterhaug

2.15 STUDIES ON THE STORAGE OF HERRING IN REFRIGERATED BRINE

Sigurdsson, G. J. (Massachusetts Institute of Technology, Cambridge)
Proceedings of the Institute of Food Technologists, pp. 91-114 (1945)

One of the problems of the sardine industry is the storage of the fish from the time they are caught until they are canned. Fish usually are preserved for a limited time by being packed in crushed ice. This method is not suitable for herring, however, as the pieces of ice bruise the soft flesh of this species. Herring must, therefore, be refrigerated by a mechanical method.

Investigations.--Storage in refrigerated brine appears to be the most feasible method of holding fresh herring. The following related factors were, therefore, investigated: (1) the effect of temp-erature on the possible length of storage; (2) the effect of the concentration of the brine on the keep-ing quality; and (3) the effect of the concentration of the brine on the rate of penetration of salt and on the change in moisture content of the fish.

Results of investigations.--The experimental results demonstrated the feasibility of storing herring for canning in refrigerated brines. The data show that, when the fish are cooled in brine, they will keep much better than when stored in air at the same temperature. There is, therefore, no doubt that for practical purposes brine cooling only should be employed. When this is done, the quality of the fish can be maintained at a high level for relatively long periods of storage, the length of time varying with the temperature and the concentration of the salt. In practice this would mean simply that, when only a few days of storage were required, a dilute brine would be used, whereas a stronger brine would serve the purpose if a heavy excess of fish were to be stored for a longer period. In the latter case, a few hours would have to be allowed for desalting the fish in fresh, running water. This operation has been shown to be easily performed and not excessively time con-suming. The changes in the moisture content of the fish during the recommended periods of storage

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ABSTRACTER: Kathryn L. Osterhaug

2.15 HOLDING SARDINES IN CHILLED BRINE

Davis, Herbert C. and Clark, G. H. (Terminal Island Sea Foods, Ltd.)
Pacific Fisherman 42, 43 (July 1944)

A number of years ago, Dr. Otto Lang of the Hooper Foundation for Medical Research experi-mented with holding sardines for varying lengths of time at different temperatures. He found that sardines could be held successfully without deterioration up to 36 hours, when the holding brine was reduced steadily from approximately 65° to 40° F. The rate of temperature decline showed approx-imately 1° per hour. Dr. Lang's work was done in the laboratory under controlled conditions, and his results might not be applicable when several tons of fish are held in fish tanks.

At San Pedro, it was found necessary to make up brine using fresh water and salt, for the water in the fish harbor could not be used as a fish-holding medium. The equipment used in these pre-liminary experiments was a small fish tank refrigerated with ammonia coils. These coils were supplied with ammonia from the necessary refrigeration equipment of a compressor and a condenser. Fresh water was placed in the tank that contained the coils, and a brine solution was made up by adding salt. During the course of the season, different concentrations of brine solution were used, varying from 3 to 9 percent. A pump took water from the bottom of the brine tank and pumped it to a 20-ton fish-holding tank that contained outlets dropped to the bottom at the center and at each corner. In practice, the brine-chilling tank is filled with water, salt is added, and then the brine is chilled for several hours to approximately 30° F. before the fish arrive at the plant.

When suitable fish arrived at the plant for chilling and holding, they were dumped into the hold-ing tank by use of the regular conveyors. The fish were allowed to drain for a period of from 20 to 30 minutes. Then all flume gates were tightly closed, the pump in the brine tank was started,

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ABSTRACTER: Kathryn L. Osterhaug

ANCHOR FOR WING-NET FISHING

TRAWL-SEINE BOATS

HERRING IN REFRIGERATED BRINE

SARDINES IN CHILLED BRINE

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Fernandina Beach, Florida, the shrimper Florida Boys was converted from purse seining back to shrimping in, roughly, four hours. The seine was reeled at the end of the day's fishing, and the purse seine gear was stowed. The shrimp trawls, doors, and cables were put aboard, and the vessel was ready to trawl for shrimp the next morning.

The basic beauty of the combination boat is this: A conventional menhaden vessel carries a 25-man crew; a shrimp trawler working as a menhaden seiner would not only handle a bigger net with less work, but would work with a 5-man crew. During a spell of bad weather, the owner could always find a little work around the boat for 5 men--something he could not possibly do for 25 men.

The essential items of equipment to convert a shrimp trawler to a purse seiner are a hydraulically driven powerblock working from the tip of the boom, an 18-foot power skiff, and a nylon purse seine. If the vessel is going to load and carry her own catch, an 8-inch fish pump running off the main engine would be desirable, although a dip-net powered by the winch would do, if money were tight.

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and the water was allowed to flow to the fish-holding tank containing the fish. Approximately 20 minutes was usually required for the chilled brine to fill the fish-holding tank and start back through the overflow to return to the brine tank, where it was rechilled and recirculated.

Fish that were originally of good quality could be held successfully under these conditions for a limited time.

2.119

depths of 3 to 4 feet. It appears likely, however, that this same equipment would work satisfactorily at depths of at least 5 to 6 feet. Also, these anchors might be found useful in still-fishing with pole and line around spawning beds and brush piles and in scientific collecting with plankton nets or bottom samplers.

The vertically mounted sockets used for anchoring a 16-foot flat-bottomed boat were made of 1-1/2-inch (inside diameter) gas pipe cut to lengths of 16 inches for the bow and 12 inches for the stern. The bracket for the bow socket was made of 4-inch channel iron; the bracket for the stern, of 3/16- by 1-3/16-inch strap iron. The sockets were welded to the brackets, and the brackets were mounted to the oak end boards of the boat with 1/2- by 1-1/2-inch lag screws.

In tests it became evident that a stake had to be strong enough to resist permanent bends and yet had to have a certain amount of flexibility. If the boat was anchored with a stake that was too stiff, anyone walking in the boat was thrown off balance by the sudden cessation of the boat's movement. Materials that were too stiff included 3/4-inch gas pipe and 18-gauge soft-drawn steel tubing of 1-1/8-inch outside diameter. A material that was too easily bent was 18-gauge soft-drawn steel tubing of 7/8-inch outside diameter.

The stake that was considered most suitable for our boat was 17-gauge hard-drawn steel tubing of 3/4-inch outside diameter. This was used in 8-foot lengths. Braised to the tubing about 1 foot from one end was a piece of 1/4- by 4-inch steel rod which had been bent to form a hook to support the stake on the top rim of the socket when the stake was not in use. The ends of the stake were closed to keep out water and mud.

Steel tubing of the kind described may be difficult to find in some localities, but any machine-shop should have catalogs of steel-supply companies from which the tubing could be ordered.

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have been found to be such that they do not adversely affect the drying load during the preliminary partial dehydration. If the fish are used at the time of this lowest moisture content, the desired degree of drying may, even after desalting, be easier to attain than it would have been if the fish were used when entirely fresh.

The temperatures necessary for successful operations will, of course, vary. Except for very short periods, however, they should not exceed 32° F. For longer storage, it is preferable to reduce the temperature still further or, if optimum results are to be obtained, almost down to the freezing point of the brine. Actual freezing of the fish should be carefully avoided since such slow or partial freezing has an adverse effect upon the firmness and texture of the muscle.

2.00 CATABOLIC PRODUCTS OF NITROGENOUS COMPOUNDS IN EARLY STAGES OF PUTREFACTION OF SQUID. I.

Nozaki, Yasuhiko and Nishimura, Chiaki
Eisei Shikenjo Hokoku No. 74, 289-94 (1956)
Chemical Abstracts 51, 8306 (June 10, 1957)

During the incubation of minced squid meat at 32° an 80% MeOH ext. (I) of some of the autolyzate is prepd. in a Soxhlet extractor for 2-dimensional paper chromatography. There appear 10 ninhydrin-pos. spots; lysine, histidine, tyrosine, proline, glutamic and aspartic acids decrease with time, while other substances increase along with autolysis. The latter substances are sepd. with Amberlite IRC 50, and then analyzed by column chromatography on Dowex 50 (Na form, 160 mm. height) by passing at pH 3.7 to 4.5, eluting with citrate buffer of pH 5.1, citrate buffer at pH 6.8, bicarbonate buffer of pH 8.3 and 0.1M Na_2CO_3 (pH 11.0), successively.

In the effluents of pH 11.0, 4 peaks are obtained besides an arginine peak and are identified as tyramine (II), histamine (III), butylamine (IV) (or tryptamine), cadaverine (V) in order by further paper chromatographic analyses. Occurrence of tryptamine is least probably, since squid meat contains no tryptophan. Paper ionophoretic and continuous paper electrophoretic analyses of nonamino acid substances of I are run tentatively.

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2.15 SARDINE CHILLING CONTRIBUTES TO CANNERY EFFICIENCY

Lang, O. W.; Farber, Lionel; and Yerman, Fred (The George Williams Hooper Foundation, University of California, San Francisco)
Pacific Fisherman 43, 56-57 (August 1945)

A far greater efficiency in cannery operations and production could be obtained if a means were provided for a packing day to start at a regular time and be completed after an 8- to 10-hour period of operation. The establishment of such a schedule depends upon a means of holding desirable catches of sardines over a period of time and under conditions that prevent rapid spoilage.

The use of prechilled brines as a means of holding sardines is a practical application of data on spoilage prevention accumulated by this laboratory.

The choice of refrigeration equipment for the temporary holding of sardines is restricted either to a shell-and-tube brine cooler with a master storage tank, to a master storage tank containing a bank of coils, or to an ice-fragment freezing unit with a master storage tank for the reserve slush ice.

The efficiency of these installations depends upon the use of a compressor of sufficient capacity to chill the desired tonnage to the holding temperature within approximately five hours and upon an adequate brine circulating system.

The brine is introduced into the sardine receiving tanks through a header system, extending either above or beneath the tanks, and then passes through a valve control into a perforated side-arm spreader pipe, extending the length and width of the bottom of each of the tanks. Several installations include a means of raising the spreader pipes on completion of operations to facilitate cleaning.

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ABSTRACTER: Kathryn L. Osterhaug

2.15 CHILLING SARDINES--EXPERIENCE WITH REFRIGERATION AS AN AID TO CANNING

Davis, H. C.; Clark, G. H.; and Shaw, Paul A. (Terminal Island Sea Foods, Ltd.)
Pacific Fisherman 43, 37, 39 (April 1945)

During the 1944-45 season, experiments (originally reported in July 1944) were continued with two improved tanks for chilling brine, each equipped with thermocouples and temperature-recording clocks, so that accurate records of operating conditions could be obtained.

Prior to the use of these new tanks, several records of fish-temperature and water-temperature relationships with respect to time were secured for the former setup of plant equipment.

With circulating water at 32° F., fish at 63½° F. were lowered to 50° F. in 1½ hour, during which time the overflow water reached a maximum temperature of 48° F. It is interesting to observe that, although the fish and water rapidly approach equilibrium and a common temperature, a slight difference of ½° to 1½° F. was continuously maintained. The fish reached 40° F. in 9 hours and 33° F. in 18½ hours, at which time the circulation was discontinued preparatory to cutting the fish. In this remaining interval of 2½ hours, fish temperature rose only 2° F., to 35° F., whereas the surface water covering the fish rose from 32° to 39° F. Following the establishment of an initial equilibrium, the rate of cooling shown by a graph averaged 1.33° F. for 6 hours and 0.89° F. per hour thereafter. This decreasing rate is a function of the insulation efficiency and becomes evident as the temperature differential between the water and the surrounding air increases.

Two new and larger concrete tanks for chilling brine were installed on the floor below the fish-holding tanks. Each of these tanks had a water capacity of 24 tons and was equipped with 1200 feet

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ABSTRACTER: Kathryn L. Osterhaug

2.15 SEA-WATER CHILLING OUTFIT INSTALLED ON SALMON SCOW

Anonymous
Pacific Fisherman 53, 50, 52 (August 1955)

Use of chilled sea water to keep salmon in prime, fresh condition during transportation to the canneries is receiving much attention from salmon canners.

One application of this method is by a firm that has equipped a 72-foot salmon scow with tanks and refrigerating machinery to be used in its Cook Inlet operation. On either side of the midships line of the scow, with a narrow space between, is mounted an insulated steel tank designed to carry 20,000 red salmon in sea water.

The tanks are 14 by 16 feet, rise 7 feet above the deck, and are insulated with 2 inches of cork. Each has a large watertight hatch and a smaller hatch on each side of the scow, with high coaming, through which fish are loaded. On each side of the scow amidships, so that boats can unload on both sides, is a vertical steel fish elevator, rising from deck level high enough to drop fish through a chute into the small hatches. The tanks are arranged to discharge (through watertight gates) on one side only by dropping the fish to the foot of the cannery elevator. Unloading is essentially automatic.

Toward one end of the scow, adjoining one of the tanks, is the refrigeration equipment--two compressors, one 15-hp and one 7½-hp--with motors and compact salt-water-cooled cupro-nickel condensers. Toward the other end is the diesel-electric power plant. Circulation of the sea water is accomplished by two 5-hp electric pumps, mounted outboard on the sides of the tanks.

Of special interest is the apparatus for chilling the sea water--called a "serpentine raceway"--

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ABSTRACTER: Kathryn L. Osterhaug

PRODUCTS OF PUTREFACTION

BRINE-CHILLING SARDINES

SARDINE CHILLING

REFRIGERATED SEA-WATER SCOW

2.15

of coils, placed in the lower third of the tank. The fish tanks were subdivided into 10-ton units, and each required approximately 3 tons of water to cover the fish.

One of the new tanks was maintained solely as a cold-water supply, and the second was used for brine circulation on held fish. This second tank, after it was dumped and cleaned from the previous night's run, was partially refilled from the first supply tank. Salt to make up the brine was added shortly before starting circulation on a new lot of fish in order to take full advantage of the added cooling from salt solution. The first tank contained only fresh water, and was always refilled following partial transfer to the second tank.

The advantages gained through use of a brine-chilling process may be outlined as follows: (1) ability to start cutting and packing at a fixed hour early in the morning prior to the unloading of new catches for that day, (2) elimination of night operation, (3) minimized difficulty of rounding up employees at uncertain hours, (4) a higher overall case pack per ton of fish received and a minimized necessity of sending good packing fish direct to the pit for reduction, (5) a resultant firmness of fish from chilling that speeds up cutting operations, reduces labor costs, and minimizes the tearing and losses that normally occur in cutting soft fish, and (6) minimized fish spoilage and handling of large numbers of fish that have become unsuitable for packing through heat deterioration.

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which occupies the space between the fish tanks. Aside from efficiency in chilling the water, its particular advantage is that it eliminates the need for placing refrigeration coils inside the tanks. Water is pumped through this raceway and is circulated through the tanks at the rate of 500 to 700 gallons a minute. This brings 50° sea water down to 30° F. in 12 hours. Salmon immersed in the chilled water at 60°, are brought down to 30° F. in 20 hours and held constantly at a temperature just above freezing, so that the progress of deterioration (which is known to increase 100 percent with a rise from 30° to 32°) is held to a minimum.

Salmon held in this way for as long as two weeks "look like they are ready to swim away." Being very little heavier than sea water, they are held in suspension so that crushing and distortion are entirely avoided; and there is no perceptible penetration of salt, as there would be in stronger brine. Even in tests of eviscerated salmon, there has been neither salt penetration nor leaching, and no loss of color.

Application of the sea-water-chilling system is not limited to transportation of fish, but also is expected to be very useful in holding salmon in the canneries before packing.

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The overflow is returned to the master storage tank by a flume extending along the top of the sardine receiving tanks; and there it is desirable to install a screening arrangement or sump to exclude solids and fats. It is advisable also to submerge the brine return into the master storage tank below the liquid level to prevent frothing.

All sardine holding tanks and brine lines should be as water-tight as possible to prevent leakage and subsequent loss of refrigeration efficiency. This quality appears to have been overlooked in a number of cases, with consequent loss of chilling rates. Since the comparatively high temperatures used will not check permanently the growth of spoilage organisms, all installations should be designed and operated in a sanitary manner. This is particularly true at the completion of an operation and when the equipment is out of use for a considerable length of time. The chilled brine should not be reused, and the sardines to be held must be of unquestionable freshness.

2.15 SEA-WATER CHILLING -- SAVES FISH -- SAVES MONEY -- SAVES WORK, TIME, QUALITY

Anonymous
Pacific Fisherman 55, 27, 29-30 (August 1957)

Holding of salmon and halibut in chilled sea water during the time that must elapse before processing is rapidly gaining acceptance in the Northwest fishing industry. Chilling units have been installed in trollers, seiners, tenders, packers, and canneries with success in the United States, Canada, and Alaska.

Fish chilled in sea water retain their fresh-caught appearance. They come out of storage days later as round and firm as when caught. The usual dents from sharp ice particles are missing, since the fish are virtually suspended in salt water. Weight of dressed fish remains the same, as there is no crushing in chill tanks. When the fish are packed layer upon layer in ice, considerable volume is lost by the sheer weight of the fish and ice on the fish at the lower levels.

One of the first successful applications of sea water chilling on a fishing boat was that applied on the Canadian troller, Phantom II. She used a plywood fish tank with cooling coils mounted on all four sides. Refrigeration was supplied by a ½-hp Freon-12 compressor, belt-driven from the boat's main engine.

S. S. M. Harrison and S. W. Roach found that compressor size should be about 1 hp per 3,000 fish. This ratio will cool the initial load of sea water from 50° to 30° F. in about 10 hours.

A Seattle firm designed and built a sea-water chilling installation for a cannery at Petersburg, Alaska. This system employs four fish bins, with sea water refrigerated in a shell-and-tube chiller

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 ABSTRACTER: Kathryn L. Osterhaug

2.15 APPLICATION OF REFRIGERATED SEA-WATER FISH HOLDING TO A HALIBUT FISHING VESSEL

Harrison, J. S. M. and Roach, S. W. (Fishery Technological Station, Vancouver, B. C., Canada)
Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations No. 108, 10-14 (September 1957)

Halibut fishing requires that the fish be held for a long time both on the fishing grounds and in transit. A study was made, therefore, to learn if holding conditions could be improved by the use of refrigerated sea-water facilities.

Sea-water facilities. --The vessel, Silver Viking, selected for this study was designed as a combination salmon seiner and halibut long-liner. Refrigerated sea-water facilities were installed while the vessel was under construction. The Silver Viking, a typical Pacific salmon seiner, is 78 feet long, 22 feet wide, and is of wood construction. Installed in her hold are six sea-water tanks made from 3/16-inch steel plate. The inside surfaces of these tanks are coated with Epoxy resin to resist corrosion. A bank of cooling coils made from 250 feet of 3/4-inch outside-diameter steel tubing, (hot dip galvanized after assembly) is located in a closed compartment along the inboard side of each of these tanks. A separate pump is provided for the circulation of chilled sea-water in each tank. Refrigeration is supplied by two condensing units: one for the three port tanks and another for the three starboard tanks. A separate shell-and-tube heat exchanger with circulating pump and condensing unit provides auxiliary sea-water chilling.

Operation A. --During July and August, the Silver Viking seined sockeye and chum salmon and held them in refrigerated sea water. After 14 days, these salmon were judged to be in excellent condition. Some round coho and jack spring salmon held in the tanks, however, lost both scales and

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 ABSTRACTER: Martin Heerdt

3.2490 YELLOW DISCOLORATION AND DETERIORATION IN FROZEN LOBSTER MEAT

Bligh, E. G.; Dyer, W. J.; and Horne, D. C. (Fishery Technological Station, Halifax, Nova Scotia)
Journal of the Fisheries Research Board of Canada 14, 637-644 (July 1957)

Introduction. --Frozen lobster meat stored at 10° to 15° F. showed most pronounced yellowing in meat packed in containers that provided the least protection against the entry of air. An extract of the hypodermis of yellow claw meat revealed a yellow pigment (not carotene) that was not present in a similar extraction of fresh claws meat. This yellow pigment had the same absorption spectrum as a yellow pigment obtained from astacene after oxidation with hydrogen peroxide.

Experimental. --To determine the cause of the yellowing, live lobsters caught during the winter season along the south shore of Nova Scotia and weighing about 1 pound, were steamed for about 15 minutes, shucked, and the meat packed into 6-ounce cans, frozen in an air blast freezer, and stored at +10° F. or -10° F. All cans received in addition, 1 ounce of 8 percent sodium chloride solution per can; and all cans were stored at +10° F. except for a single lot of cellophane-window cans stored at -10° F. Lots were packed as follows: (1) hermetically sealed cans (controls), (2) cellophane window cans, (3) hermetically sealed cans that had been flushed with oxygen gas, (4) hermetically sealed cans with salt solution that contained 0.3 percent ascorbic acid, and (5) hermetically sealed cans with salt solution that contained 1.0 percent ascorbic acid.

Each experimental pack of lobster meat was examined every three or four weeks. Meat from the tips of the claws, the main part of the claws, and the tail was used for crude fat determination according to the method given in A. O. A. C. (1950). Free fatty acid and peroxide content of the fat were determined according to the methods described by Dyer and Morton (1956).

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 ABSTRACTER: Martin Heerdt

3.2497 FROZEN FISH -- STORAGE

Kuprianoff, J.
Kaltetechnik 8, p. 102 (March 1956) (Karlsruhe, W. Germany)
World Fisheries Abstracts 8, 33-34 (May-June 1957)

It is important, especially for economic reasons, to know the optimum temperature for maintaining a certain product in good condition for an anticipated period of storage. The initial state of the product, before freezing, must also be known, approx. The possible changes in the raw material during storage before freezing are illustrated, showing the dependence of temperature of storage on decrease of vitamin C in freshly harvested vegetables. As an example of a characteristic value, which allows an evaluation of the decrease in total quality of a food during frozen storage, a discussion is given of the results of Notevarp on the decrease with time (z) in the quality of cod fish, stored at different temperatures, (t). From these data, the temperature coefficients for the lowering of quality of frozen fish are calculated.

For the 3 tested quality levels, "excellent," "good," and "still suitable," the same q_{10} values of 3.1 were calculated. It is assumed that a general relationship between temperature and decrease in quality exists. It would mean that limits for the same quality level of a given fish species can in first approximation be represented as a straight line in a t log z graph. With a single point of another quality level, the corresponding straight line can be plotted in the same diagram as running parallel.

The changes occurring in the fish during cold storage at different temperatures under uniform storage conditions are generally proportional to duration of storage. From numerous, statistically determined test values from other authors, the "limit curves" of the 3 different quality levels are plotted for frozen fat fish (Fig. 1 omitted) and frozen lean fish (Fig. 2 omitted) in a t log z graph.

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 ABSTRACTER: W. Partmann

SEA-WATER CHILLING

SEA-WATER CHILLING APPLICATION

DISCOLORATION IN FROZEN LOBSTER

FROZEN FISH STORAGE

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skin pigments. This difficulty was overcome by dressing all of the fish instead of merely a few individual fish. The stomach contents of actively feeding salmon contain a destructive enzyme that may have caused this damage.

Operation B.--During September, the Silver Viking caught 36,000 pounds of halibut. These were still in excellent condition when they were sold 8 to 15 days after capture. Halibut from this trip, held in refrigerated sea water for a total of 29 days, remained in good marketable condition.

Chiller design.--The shell-and-tube sea-water chiller was installed to assist in the initial cooling of sea water and for use in the event of an emergency. The chiller was designed with a close tube spacing to permit a high water velocity, high heat transfer, and small outside dimensions for ease of installation and maintenance. Sea water could be cooled to 30° F. with this equipment without freezing out as ice on the tubes.

A 6-inch Kralastic pipe was used as an outer shell for the sea-water chiller to reduce the weight of the chiller, eliminate corrosion of the shell, and provide elasticity in the event of freeze-up. This shell enclosed 240 feet of 5/8-inch outside-diameter copper tubing arranged for dry refrigerant expansion in six parallel circuits of four horizontal runs of tubing, which extended the full length of the shell. Twenty semi-circular baffles were used to direct the flow of sea water across the tubes.

The success of this sea-water chiller may result in major changes in the design of present day refrigerated sea-water equipment. The authors believe that chillers of this type can be relied on entirely for cooling in place of tank coils. This change, in turn, would affect other components of a refrigerated sea-water system.

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A fresh fat fish fillet of best quality shows the lower limit of satisfactory quality at -20° C. (-5° F.) after 5 month's storage. If a fat fish, e.g., after a short time prestorage in ice, shows only the quality of the "good" range, it can be marked only as scarcely satisfactory after a storage time of about 2½ months at -20° C. At a storage temperature of -30° C. (-22° F.), this lower quality level is reached only after 5 months. From the limit curves for different products the temperature coefficients were calculated. For cold storage changes of fish and fish products, Q_{10} values from 2.7 to 3.5 were found in the temperature range from -10° to -20° C. (14° to -5° F.) and between 2 and 2.4 in the range from -20° to -30° C. The observed drop of the Q_{10} values with decreasing temperatures, which is in contrast to the general rule, was also found with other frozen products. The decrease of Q_{10} points out that the conditions of reactions in fish and the reacting substances which cause changes in fish during storage are changed considerably with the decreasing temperature.

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connected with a central ammonia refrigeration system.

One of the first vessels designed and built expressly for transporting fresh salmon in chilled sea water is the 74-foot steel-hulled fish carrier, Snow Mist. The Snow Mist carries fish "dry" on short hauls and uses her sea-water chilling system for longer distances. Her two sea-water tanks hold 5,000 gallons each, with a circulation of 200 gallons per minute. These fish tanks also are cooled by overhead coils to permit their use for "dry" transport at about 30° F., when desired. Forward of the sea-water tanks is a "dry" refrigeration hold about 18 feet long. This hold, like the sea-water tanks, is fully cork insulated, with refrigerating coils overhead.

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Color changes.--Lobster packed in hermetically sealed cans that had been flushed with oxygen gas became yellow after only 3 weeks in storage at +10° F., whereas the controls showed no change in color until after 10 to 14 weeks of storage. Lobster packed in cellophane window cans and stored at +10° F. showed yellow discoloration of claw tips after 11 weeks of storage; whereas lobster packed in cellophane window cans and stored at -10° F. did not become discolored until after 25 to 28 weeks. Lobster packed with an ascorbic acid solution did not become discolored.

Texture changes.--Lobster controls held at +10° F. and lobster packed in cellophane window cans held at -10° F. showed little change in texture after 28 weeks of storage when the experiment was terminated, whereas lobster packed in cellophane window cans and stored at +10° F. became tough after 14 weeks of storage. The lobster packed with 1.0 percent ascorbic acid became tough and acquired an acid taste after only 3 weeks of storage, whereas lobster packed with 0.3 percent ascorbic acid merely became tough after about 10 weeks of storage. Press juice from these two lobster packs showed respectively, a pH of 5.65 and 6.55, whereas the pH of lobster controls was 7.0.

Oxidative changes.--Significant changes did not occur in the existing free fatty acid content (12 to 14 percent) of the extracted fat in any of the samples. Lobster packed with 1.0 percent ascorbic acid did not exceed a peroxide value of 1.0 milliequivalents per 100 grams of fat, whereas the peroxide values of lobster controls did not exceed 4 to 5 milliequivalents per 100 grams even after prolonged storage. Lobster packed in cans that had been flushed with oxygen gas reached a peroxide value of 8.7 milliequivalents in the claw tip meat after 3 weeks, whereas a similar value was not reached in the control lobster until after 14 weeks of storage. Lobster claw meat packed with 0.3 percent ascorbic acid had a peroxide value of only 5.5 milliequivalents after 30 weeks of storage at 10° F. These studies indicated that the peroxide value of the fat will reach a level of 8 to 11 milliequivalents before any color change occurs in the meat. In conclusion, fat oxidation is the primary reaction in the yellowing of lobster meat; and this reaction is followed by oxidation of the red pigment, probably by fat peroxides that are formed. Off-odors and off-flavors that accompany the yellow color are due at least in part to rancidity.

3.12 EFFECT OF AUREOMYCIN, NITRITE AND RICINOLEATE ON RED HALOPHILIC BACTERIA

Venkataraman, R.
Current Science 25, p. 190 (June 1956) (Bangalore, India)
World Fisheries Abstracts 8, 35-36 (July-August 1957)

(a) Cultures of Pseudomonas salinaria, Ps. cutirubra, Bacterium trapanicum, B. halobiom, Micrococcus morrhuae, M. roseus halophilus, Sarcina littoralis, S. morrhuae, Halobacterium minutum, H. Gibbonsii (N. sp.), Sarcina marina (N. sp.) and other red halophilic bacteria were grown on salt-milk agar to which known quantities of aureomycin, sodium nitrite and sodium ricinoleate, were added. The final pH was adjusted to 6.5 ± 0.1. Surface inoculation was made by streaking.

Excepting H. gibbonsii, none of the other red halophiles was affected by even 10 p.p.m. of aureomycin. Growth was as profuse and rapid as the control and no morphological changes were noticed either. It is surmised that the high magnesium content of the medium reverses the action of aureomycin. 0.1% of $NaNO_2$ did not retard growth of cocci and 0.2% of it slowed growth but did not inhibit the cocci. At 0.5% some cocci still showed growth. But the rod forms failed to grow with 0.2% $NaNO_2$ with sodium ricinoleate at 0.2% level only rod forms grew and all the cocci were suppressed. It is suggested that for salting hides a combination of 0.2% $NaNO_2$ and 0.2% sodium ricinoleate be used though this high concentration of nitrite is not recommended for curing fish.

 ABSTRACTER: R. Venkataraman

3.25 FRESH FISH 4. TRANSPORT OF QUICK-FROZEN VS. ICED FISH

Cooper, C. E. B.
Annual Report of the Fishing Industry Research Institute, Cape Town, South Africa 9, 9 (1955-1956)

The quality of frozen fish transported by rail was compared with the quality of iced fish transported by rail to inland markets. Frozen fish can be hauled by rail at a lower cost than iced fish; however, when the frozen fish is allowed to thaw, it usually is somewhat softer than iced fish and sometimes is slightly discolored.

Experimental.--Several tests were made to investigate the effect of freezing and thawing procedures on hake. These procedures were those that might be encountered during the rail transportation of frozen fish packed in ice or packed uniced in air.

Test 1.--Hake that had been frozen from 32° to 23° F. in 8 to 9 hours and from 23° to 0° F. in an additional 12 or more hours were stored in air at 0° F. These fish then were removed from storage, thawed slowly while packed in ice over a period of 3 days, or thawed rapidly packed uniced in air over a period of 8 hours. The hake then were compared with hake from the same catch that had been stored throughout this period in ice. The comparison showed slight brown discoloration and soft flesh in the hake that had been frozen.

Test 2.--Hake that averaged 1½ to 2½ pounds in weight after they had been headed and gutted, were frozen (unwrapped) by direct immersion in saturated sodium chloride brine at 0° to -5° F. The brine was stirred slowly during the freezing period. To freeze the thickest part of the hake to 23° F. or below required 30 minutes. Six hake 1½ pounds in weight, however, reached 23° F. in 22 minutes. These hake then were removed from the freezing brine, stored at 0° F. for 2 and 3 days, thawed in

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 ABSTRACTER: Martin Heerdt

3.2497 INFLUENCE OF INTERMITTENT SHORT STORAGE PERIODS AT 15° F., AS ENCOUNTERED DURING REFRIGERATOR CAR TRANSPORTATION, ON THE QUALITY OF FROZEN COD STORED AT 0° F.

Dyer, W. J., Fraser, Doris I., Ellis, D. G.; and MacCallum, W. A. (Technological Station, Halifax, Nova Scotia)
Journal of the Fisheries Research Board of Canada 14, 627-635 (July 1957)

This paper reports on the effect of two weeks storage at 15° F. on commercially frozen cod fillets.

Experimental.--Fresh cod fillets were packed in waxed cardboard cartons, wrapped with wax paper, frozen, and stored in master cartons (cases), 12¾ by 9 by 8½ inches in size, that held twenty-four 1-pound packages. The rate of change of temperature in the master carton was measured with a thermometer placed midway between the two sides and just short of the center. Master cartons were equilibrated for several days at 0° F. and then transferred to thermostatically controlled storage at 15° F. Temperatures within master cartons rose markedly during the first few hours of storage; however, they did not reach a uniform temperature even after 30 hours. The steepest temperature gradient was between the wall of the master carton and the adjacent 1-pound package of fish.

To learn the effect of short periods of storage at 15° F., as in shipment by refrigerated car, master cartons full of frozen cod fillets were removed after 1 month at 0° F., held at 15° F. for two weeks, and then returned to 0° F. In like manner, master cartons were removed after 3, 6, and 9 months of storage at 0° F., held at 15° F. for two weeks, and then returned to 0° F.

The effect of a possible second trans-shipment by refrigerated car was also measured. Master cartons full of frozen cod were removed after 1 month at 0° F., held at 15° F. for two weeks, and then

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 ABSTRACTER: Martin Heerdt

3.332 FISH CANNING 1. CHILLING OF PILCHARDS

Cooper, C. E. B.
Annual Report of the Fishing Industry Research Institute, Cape Town, South Africa 9, 13-14 (1955-1956)

Introduction.--During 1955 field tests, pilchards were chilled in large tanks containing sea water and crushed ice. The purposes of these tests were: (1) to study the rate of cooling and the temperature distribution of the fish in the tanks; (2) to study the performance of an existing water-chilling plant; (3) to study the chilling of whole fish versus the chilling of cut fish; and (4) to study the rewarming of pilchards before sorting and evisceration.

Chilling and temperature distribution.--Pilchards in the round will float in about ⅓ their weight of sea water. To chill fish and sea water from 57° to 40° F., therefore, requires (2000 x 17° x 0.8) + (670 x 17° x 1.0) or 38,600 B.t.u. per ton of fish. This is equivalent to the melting of 270 pounds of ice. A 6½ x 6½ x 4 foot wooden holding tank full of fish at 20° F., requires about 1600 B.t.u. or 11 pounds of ice per hour.

In the studies described here, crushed ice was added in part to the holding tank before the fish were added, and in part to the stream of fish and water as they entered the tank. To measure temperatures throughout the tank, copper constantan thermocouples were pressed into the back of individual pilchard and tied firmly in place. These fish then were placed at desired points in the mass of fish in the holding tank. The amounts of sea water used in these experiments were varied, and the effects of these variations on cooling and temperature distribution were tabulated. Results from four tests showed that: (1) crushed ice will chill fish and sea water in holding tanks to less than 40° F. in 1½ hours; and (2) the uniformity of fish temperatures can be improved by adding sea

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 ABSTRACTER: Martin Heerdt

ANTIBIOTICS FOR FISH

INTERMITTENT STORAGE AT 15° F.

TRANSPORTATION OF FROZEN FISH

CHILLED PILCHARDS FOR CANNING

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returned to 0° F. The same master cartons, three months after they had been packed, were again removed from storage at 0° F., held at 15° F. for two weeks, and then returned to 0° F. In like manner, master cartons full of frozen cod were removed after 3 months at 0° F., held at 15° F. for 2 weeks, returned to 0° F. for 2½ months, removed from 0° F. and held at 15° F. for an additional 2 weeks, and then returned to storage at 0° F.

Assay.--The quality of the samples of frozen cod that were held in storage was checked at intervals by soluble protein determinations and by a taste panel. The content of moisture, total nitrogen, nonprotein nitrogen, free fatty acids, trimethylamine, and trimethylamine oxide also were determined.

Results.--Frozen cod fillets held for 2 weeks at 15° F. after previous and subsequent storage at 0° F. deteriorated in quality more rapidly than frozen cod fillets held constantly at 0° F. Protein solubility and taste panel sensory scores also declined. A second interval of storage at 15° F. further reduced the subsequent quality of the frozen cod fillets normally held in storage at 0° F. Deterioration during the second interval was about the same irrespective of whether the 15° F. storage interval was given after 1, 3, or 6 months of storage at 0° F. Refrigerated car transportation at 15° F. for short periods of time does affect the quality of frozen fish normally held at 0° F. or below. An effort should be made, therefore, to provide lower refrigerated car temperatures.

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water in excess of the minimum required; however, this causes a slight increase in average fish temperatures to above 40° F.

Water-chilling plant.--An existing sea-water-chilling plant, normally large enough to chill 6 tons of pilchards and sea water in 2 hours, was studied. When this plant was put into use, the sea water became contaminated with a high content of solids and excessive foaming occurred. When this water-chilling plant was operated for 12 hours on one tank, water delivery temperature did not fall below 49° to 50° F. and water return temperature did not rise above 51° to 53° F. The temperature of the fish in this tank remained throughout at 54° to 56° F. These conditions made it impossible to compare ice chilling with sea-water chilling.

Cut fish chilled and compared with whole fish.--Two tests were made to compare pilchards from the same catch, some of which were chilled before cutting and the remainder of which were chilled after cutting and evisceration. Part 1, of this test made use of 600 pounds of whole fish, whereas part 2, made use of 2,000 pounds of cut fish. The whole fish were held for 5 hours at an average of 35° F., whereas the cut fish were held for 5 hours at an average of 42° F. No significant differences were found in the firmness of canned pilchards prepared from samples chilled before or after cutting and eviscerating. A slight weakening of flavor appeared to be perceptible in the cut fish.

Rewarming of chilled pilchards before sorting, cutting, and eviscerating.--Pilchards that previously had been chilled to 32° to 33° F. were put through the cutting and eviscerating machine and then examined for the amount of gut that was retained. In pilchards that were gutted at 33° F., twelve out of twenty-five fish (48 percent) retained portions of gut in the belly cavity. All cuts, however, were sharp and clean. In pilchards held at 35° to 36° F., four out of forty fish (10 percent) retained portions of gut. In pilchards held at 40° F. two out of 100 fish (2 percent) retained portions of gut. In pilchards from the same catch that had not been chilled, 2 percent of the fish retained portions of gut. To avoid having the sorters' hands become uncomfortably cold, it was necessary to warm the pilchards to 45° F. This temperature, therefore, can be regarded as the minimum for cutting and sorting chilled pilchards.

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80° F. air moving at the rate of 800 to 900 feet per minute, or thawed in an excess of 80° F. running water. Complete thawing to above 32° F. required less than 3 hours in moving air and less than 1 hour in running water. The hake that had been frozen and thawed in this experiment were externally indistinguishable from a control group of hake that had been stored throughout this period in ice. The flesh of the water-thawed hake was almost as white as the flesh of the iced hake when fillets were cut and examined. The texture of the water-thawed hake, however, was slightly softer and less crisp than the texture of the iced hake. Steamed or boiled fillets cut from frozen or iced hake were practically indistinguishable from one another. Quick frozen hake that were thawed for 3½ hours in still air at 80° F., or for 3 days in still air at 40° F., produced fillets that were less acceptable than fillets cut from iced hake because of slight discoloration and softness in the frozen hake fillets.

3.19 THE RADIATION PRESERVATION OF FOODS

Anonymous
Chemistry and Industry No. 24, 754 (June 15, 1957)

This is a report of a talk delivered by Dr. R. S. Hannan of the University of Cambridge before the Food Group of the Society of Chemical Industry in the Town Hall at Folkestone on April 30, 1957.

The radiations of concern to the speaker were those that could impart sufficient energy to an irradiated atom to cause the ejection of an orbital electron. Sources of radiation could be either radioactive compounds or electrical generators and the size of sample could be up to two or three feet thick, depending on the source available. The larger the organism irradiated, the more easily was it inactivated, usually; thus the lethal dose for man was less than 1000 rads while a dose of millions of rads was necessary for the inactivation of bacterial spores. Cell reproduction was especially sensitive.

In the simplest form of processing the source of radiation would be a radioactive fuel rod withdrawn at the end of its useful life from a nuclear reactor. Alternatively a specially designed nuclear reactor producing gamma radiation, or an electrical generator producing cathode rays, might be used; linear accelerators of the latter type suitable for pilot plant working were commercially available in Britain. Thick concrete shields were necessary in all cases. Tentative calculations indicated that the cost of sterilization would be of the order of a few pence per pound, being eventually, perhaps, about one penny per pound. Treatments requiring lower doses, such as for insect inactivation or sprout prevention, would (where practicable) be correspondingly cheaper.

Although doses of hundreds of thousands of rads were necessary for insect destruction, radiation at about one-tenth of this dose would interfere with reproduction; this promised to be of practical

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3.5 PRESERVATION OF FISH BY SALTING AND DRYING

Gunasekera, C.; De Silva, N.; and Lantz, A. W. (Fisheries Research Stations, Ceylon)
Ceylon, Department of Fisheries, Progress Reports Biological and Technological No. 2, 44-47 (July 1956)

Purpose.--This study was made to develop a satisfactory commercial curing process for dried salted fish that are prepared in three stages: (1) dressing, (2) salting, and (3) drying.

Dressing.--Viscera and gills were removed to eliminate a source of decomposition, and the head and backbone sections were removed to avoid discoloration and rancidity of the oil. Good quality fillets require the removal of these bony portions for separate processing. To remove surface and diffused blood the fillets were brined in a 10-percent salt solution for one-half hour.

Salting.--Experimental salting was carried out with fillets or clean cubes of meat of the Catfish, Tachysurus (Netuma thalassinus), one of the varieties commonly cured in Ceylon. Dry salt rubbed into the cubes or fillets proved unsatisfactory as salting was uneven, and the exposed catfish meat attracted flies during the early stages of cure. Next, the cubes or fillets were rubbed with dry salt and then placed in a vessel to permit formation of a brine. Sufficient saturated salt solution containing solid salt was added to cover the fish. This method proved more satisfactory because the brine protected the fish and ensured even salting. Fillets in saturated brine containing solid salt remained stable for over two months. Fungus growth on the surface of the fat layer was removed frequently; or if the fungus could not be removed completely, the entire salt solution was replaced.

When fish is immersed in brine, the moisture in the fish diffuses into the brine and the brine penetrates into the fish. To follow the process, moisture and salt analyses were made on fish fillets

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 ABSTRACTER: Martin Heerdt

3.4 FILM PACKAGE OPENS BIG MARKET FOR AGE-OLD PRODUCTS

Anonymous
Food Engineering 29, 71 (October 1957)

To increase retail distribution, smoked fish, heretofore distributed in bulk, is now sold in modern plastic bags.

A large fish-products firm recently decided to pack all of its smoked and kippered fish in modern plastic bags in order to increase its market. Officials of the firm decided that they must include chain stores in addition to delicatessen and specialty stores if they were to broaden their market. The need for a better package was immediately apparent.

Precooked, cured fish require refrigerated display space, and must be wrapped to prevent odor transfer to dairy and meat products. For mass distribution in self-service refrigerated display cases, a name-branded product in an eye-catching package is also required.

Experimental packs of smoked fish in plastic bags were tested in retail chain stores in New York, Philadelphia, Washington, D. C., and Chicago. Consumer acceptance was good. The original cellophane-polyethylene laminated bag, however, was inadequate with regard to moisture-vapor and color retention.

A new film bag made from laminated Mylar, Saran, and polyethylene was tried in place of the original test bag. An entire line was accommodated by using three bags ranging in size from 5½ x 7¾ to 6 x 10 inches. This line consisted of lox, kippered salmon and sable fish, smoked eels, smoked whitefish, and smoked whiting.

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 ABSTRACTER: Martin Heerdt

3.5 SALTED AND DRIED FISH

Dreosti, G. M.; Edwardes, C. A.; and Rowan, M. K.
Annual Report of the Fishing Industry Research Institute, Cape Town, South Africa 9, 10-11 (1955-1956)

1. Use of sodium bicarbonate in brining hake.--A study was made to learn if the treatment of hake with sodium bicarbonate before or during salting would result in more tender fish after desalting.

Experimental.--Freshly caught, headed, and gutted hake, each weighing about 1½ pounds, were placed in small bins with salt below, between, and above the layers of hake and covered with a saturated brine. A second and third lot of hake were similarly treated, but with salt that contained 2 percent and 6 percent sodium bicarbonate, respectively. All of the lots of salted hake were held at 40° F.

Results.--After each of the lots had been salted for 7 days, the hake were filleted and desalted for 6 hours in running water. The control lot that had been preserved with salt only, had a more fishy odor and a slightly tougher or more rubbery texture than lots 2 and 3. After hake from the control lot had been cooked in 5 times its weight of water, it was slightly tougher than similarly cooked hake from lots 2 and 3. Almost no differences were apparent between the salted hake that received, respectively, 2 percent and 6 percent sodium bicarbonate; however, both of these lots had a more neutral flavor than hake from the control lot. A faintly foreign taste also was detected in bicarbonate-treated hake.

Each of the lots of hake had a similar salt content after cooking. The salt content, however, could be further reduced by soaking the hake for long periods in chilled water at 32° F. Hake that had

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 ABSTRACTER: Martin Heerdt

RADIATION PRESERVATION

FILM BAGS FOR SMOKED FISH

SALTING AND DRYING FISH

REUSE OF SALT

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The sliced salmon, lox, and whitefish are nitrogen gas packed to prevent the pieces from sticking together. The other products are vacuum packed to protect them from loss of flavor. Packaging is carried out at the rate of 36 bags per minute. The bags then are packed in 5- or 10-pound protective cartons which in turn are packed in a shipping carton. The film bags are reverse branded with red on the Mylar prior to use to identify the manufacturer and with a wave pattern of gold, red, yellow, orange, white, light blue, or dark blue to identify the product. Recipes and serving suggestions appear on the back of the bags to familiarize new customers with the dinner and party possibilities of the products.

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been soaked for 8 hours in 4 to 5 times its weight of water and 16 hours in fresh ice-water slush before it was cooked for 15 minutes in five times its weight of water had a salt content of 1.1 to 1.9 percent in the thickest ($\frac{3}{4}$-inch) parts.

2. Reuse of salt for salting hake.--Fresh hake were filleted and salted below, between, and above the layers of fish at the rate of 1 pound of salt per pound of hake. After the hake had been in salt for 7 days, during which period the liquid was drained away from the hake continually, the hake were hung at room temperature until dry. Wet salt recovered from the first lot of salted hake was used to salt a second lot of hake; and, at the same time, a second similar lot of hake was salted with fresh salt from the original bag. Wet salt from these two lots was recovered, combined, and used to salt a third lot of hake. As before, a control lot was salted with fresh salt from the original bag. All of these lots of hake were held for 7 days in salt and then hung at room temperature.

Results.--Controls for each lot of hake and the hake salted with once-used salt had no off-odors or flavors either after salting or after drying. Hake salted with twice-used salt, however, were sour, had the typical cheesy odor of pinked fish, and showed heavy pinking after 7 days in the salt. Samples of all of the salts then were assayed by the drop plate method. Only one red colony developed in a 1 to 100 dilution of unused salt after 24 days of incubation. Once-used salts, however, produced abundant growth of red colonies at all dilutions with the first colony appearing after only 10 days of incubation. After 14 days the 1 to 100 dilution plates showed 76 and 69 colonies, whereas the 1 to 1000 dilution plates showed 10 and 18 colonies, respectively.

With twice-used salt, red colonies first developed after 7 days, and at the end of 12 days they were innumerable in all dilutions. These results indicate a large and progressive multiplication of the bacteria present in the original salt with an accompanying marked decrease in the lag period. Rapid multiplication of halophiles can cause considerable loss from pinking if the salt is reused. In addition, wet salt was difficult to spread evenly. If the wet salt was dried, it caked badly and required milling before reuse.

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use particularly for packaged items, provided that flavor changes could be avoided. In controlling microbial spoilage, sensitive organisms (such as Pseudomonas geniculata) responded to doses of about 100,000 rads, most vegetative microorganisms required from 250,000 to one million rads, Cl. botulinum might require five million rads and viruses were usually even more sensitive than bacterial spores.

Irradiation could also produce chemical changes in foods which, although small in amount, could lead to effects which were immediately obvious as loss in quality, e.g. deteriorations in color, odor or flavor. These changes were relatively small at dose levels which gave a useful increase in the storage life of meats under refrigeration. The prospect of producing sterile raw meats for commercial markets was limited, however, although the undesirable effects could be minimized by irradiating in the frozen state and by the addition of protective compounds such as ascorbic acid. The most likely trend of future work on meat products would be treatment in combination with other processes. Packaging materials were easily sterilized by irradiation. At present there was no indication that irradiation produced toxic substances although the absence of long-term toxicity, and particularly carcinogenicity, was much less readily demonstrated, and considerable work would be necessary before irradiated foods could be accepted as harmless at all but the lowest dose levels.

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immersed in saturated brine containing solid salt. Before immersion the moisture content of the fish was 77 percent and salt was negligible. After 2 and 7 days immersion in saturated brine, the moisture and salt content was at and remained at 55 percent and 21 percent, respectively. This ratio represented a 27 percent by weight, for weight or saturated salt solution in the fish and was made possible only by the use of a brine that contained solid salt. The oil content of the meat decreased during processing from an original 22 percent of oil in the raw flesh as calculated on a dry weight basis to 11 percent oil after salt saturation and 4 percent oil after prolonged air drying.

Drying.--Beach drying on racks under covered sheds, which permits free circulation of air, provided favorable conditions for a satisfactory cure if decomposition of the meat could be controlled during this comparatively slow drying process.

Control of bacterial decomposition.--Rapid spoilage changes in fish muscle can generally be controlled by a concentration of approximately 15 percent salt. However, certain strains of marine bacteria tolerate high concentrations of salt, and a few require salt for their growth. These bacteria are called "halophiles." Pigment producing groups known as red halophiles together with certain molds are the chief agents responsible for deterioration in salted fish. Good sanitation in handling fish during dressing, salting, and drying is essential; however, sterile methods of manufacture are impractical under local conditions. Locally, lime juice (citric acid), vinegar (acetic acid), and goraka (tartaric acid) are used as flavorings and as preservatives; therefore the use of citric acid as a chemical preservative for dried fish was investigated. Mixed strains of red halophiles isolated from salt fish and grown in a special medium were unable to survive beyond a 2 percent concentration of citric acid which also (1) controlled the growth of all types of contaminating fungi, (2) increased the initial rate of salt penetration, and (3) protected the product from decomposition during air-drying by a slow but locally desirable process in a covered shed.

Application of methods.--The foregoing methods were applied to the salting of 100 pounds of catfish fillets obtained from 200 pounds of raw material. Four gallons of water, to which were added 35 pounds of salt and 2 pounds of citric acid, were used. After 3 days of brining to ensure complete salting, the loss in weight of the fillets was 10 pounds. After complete air drying the fillets weighed 60 pounds and contained 35 percent moisture.

3.332 CANNING METHODS AND EQUIPMENT -- PRECOOKING

Witte, H.
Fette, Seifen, Anstrichmittel 58, p. 423 (June 1956)
World Fisheries Abstracts 8, 39-40 (July-August 1957)

Eighteen samples of 200 g. (7-1/16 oz.) net weight cans of herring in tomato sauce, bought in retail shops in Germany, 1955, showed net weights of fish varying from 87 to 159 g. (3-1/16 to 5-5/8 oz.), a fat content of the sauce between 5.7 and 21.8% and a water content of the sauce between 86 and 69%. Experiments were made to find the cause of these large variations. Cans of the same size were filled with exactly 110, 120 or 130 g. (3-5/8, 4-1/4 and 4-1/16 oz.) of herring fillets precooked in the normal way, or with 130, 140 or 150 g. (4-1/16, 4-11/16 and 5-5/16 oz.) of herring fillets, uncooked or precooked by infrared irradiation. As packing medium, the following liquids were used: normal tomato sauce, a thinner tomato sauce, edible oil, 3% salt solution or water. All cans were filled to the brim, closed and sterilized under pressure, as in the normal, commercial production. One can of every kind was opened immediately after sterilization, the next 2 after being kept 3 weeks at 35°C. (96°F.) and the last ones after 6 weeks' storage at room temperature.

The changes in the weight of the fish are given in a table (see over) and in graphs. Neither the type of sauce nor its amount proved to have any influence on the weight loss of the fish during sterilization and subsequent storage. Upon sterilization, the fish fillets always lose a certain amount of fluid, which is slightly augmented during storage. In addition, a small amount of fat is exuded. Precooked herring fillets (from the beginning of the 1955 season) lost approx. 10% during sterilization and a small percentage during subsequent storage. Uncooked fillets lost as much as 18 to 20% in sterilization and fillets which had been infrared cooked lost 12 to 15%, possibly because in these fillets only the outer layers had been sufficiently preheated. This shows that a favorable weight yield

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ABSTRACTER: C. J. H. van den Broek

3.60 SOME ASPECTS OF THE TEXTURE OF DEHYDRATED FISH

Connell, J. J. (Torry Research Station, Aberdeen, Scotland)
Journal of the Science of Food and Agriculture 8, 526-537 (September 1957)

Several types of acceptable dehydrated fish products were developed during the years 1939 to 1945. All of these products were prepared from minced fish; therefore, they could be used only in recipes such as chowders and fish cakes.

Purpose.--In recent years, studies have been made at Torry Research Station to find a successful means of dehydrating whole fish fillets. Some of the findings are reported below.

Results.--According to these findings, cod fillets that are dehydrated in a current of warm air undergo gross changes in microscopic structure. Sections of reconstituted cod fillets showed a coherent, compact structure with few interfibrillar spaces. These cod fillets absorbed less than one-fourth of their original moisture after they were soaked in water for 125 minutes. In contrast, vacuum contact-dried cod fillets showed areas of fused muscle fibers that were separated by large spaces. These fillets absorbed almost 100 percent of their original water content after 125 minutes of soaking. Freeze-dried cod fillets retained typical spindle-shaped spaces that were induced by the formation of ice crystals, even after reconstitution. Water absorption by these fillets was not as rapid as water absorption by cod fillets that had been dried by the vacuum contact-plate process. Both freeze-dried fillets and the best vacuum contact-plate dried fillets absorbed water rapidly during their initial reconstitution.

Fillets that were frozen rapidly before they were dried were completely dry inside after 2 hours of soaking. It appears, therefore, that the absorption of water through the small pores of

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ABSTRACTER: Martin Heerdt

4.15 FATTY ACID COMPOSITIONS OF INDIAN SHARK LIVER FATS

Pathak, S. P. and Dey, L. M. (Banaras Hindu University, Banaras, India)
Journal of the American Oil Chemists' Society 34, 425-426 (September 1957)

Previous research has shown that Elasmobranch fish liver fats can be classified roughly into four groups on the basis of unsaponifiables and saturated fatty acids contents. In the first three groups, only about 20 percent of the fatty acids are saturated. Very little data were available on the fourth group until recent work by Pathak et al. definitely proved the occurrence of such fats in Asiatic varieties of shark liver. The data have now been extended by the analysis of liver fats from two varieties of Elasmobranch fish caught on the West Coast of India, namely, Carcharias limbatus and Pristis cuspidatus. The liver fats belong to the fourth group, because they were found to contain about 40 percent saturated fatty acids.

The investigation of the component fatty acids of both fats was carried out, using a lead salt-lithium salt separation technique.

Comparative data of C. limbatus and P. cuspidatus liver fats show great similarity in their compositions, although they belong to different families. The total saturated acid contents are 38 percent and 42 percent, respectively. Palmitic acid is the predominant saturated acid.

The most striking feature in the case of P. cuspidatus liver fat was its high (12.5 percent) content of unsaponifiable matter. Fortunately another sample of liver fat from P. cuspidatus caught on the East (Malabar) Coast was studied and found to contain only a negligible quantity of unsaponifiable matter.

It is clear from the data presented that there is a definite tendency for the fat to be more saturated with the appearance of unsaponifiables. This supports Lovern's view (Biochem. J., 31, 755 [1937]) that "disappearance of polyethenoid unsaturation in the higher fatty acids accompanied by the appearance of alcohol ethers of selachyl type are both to be regarded as evidence of an unusual tendency towards unsaturation or hydrogenation in fish liver fats."

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ABSTRACTER: Edward H. Gruger, Jr.

4.21 COMPARISON OF METHODS FOR TESTING THE STABILITY OF FATS AND OILS, AND OF FOODS CONTAINING THEM

Gearhart, W. M.; Stuckey, B. N.; and Austin, J. J. (Eastman Chemical Products, Inc., Kingsport, Tennessee)
Journal of the American Oil Chemists' Society 34, 427-430 (September 1957)

A comparison is made between the conventional Active Oxygen Method, the School Oven Method and a modified ASTM Oxygen Bomb Method for determining the stability of fats and oils, and of fatty or oily foods.

The active Oxygen Method consists of heating samples of fat or oil in glass tubes at 99°C. and blowing washed and dried air through the samples at a constant rate. Approximately 0.2 gram samples are priodically withdrawn, and the peroxide value of those samples is determined.

The School Oven Method employs a trained panel of three or more people, which checks the odor daily of each of four samples of crackers, potato chips, and pastry prepared using the test fat under standard conditions. In the interval between tests the samples are stored in 4-ounce jars in an electrically heated convection-type oven maintained at 63°C.

The ASTM Bomb Method is used by the petroleum industry and by the authors' laboratory for determining the stability of gasoline to gum formation. The method was adapted to the testing of fats or oils as well as to foods prepared with fats or oils. The method involves placing 15 grams of solid or 30 grams of liquid in a glass container, which is inserted into a stainless steel bomb. The bomb is flushed with oxygen and charged with 50 to 100 psi of oxygen depending on the nature of the sample. The pressure-drop is read by a recorder, which automatically plots pressure versus time.

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ABSTRACTER: Phillip A. Hart

FISH CANNING

TEXTURE OF DEHYDRATED FISH

SHARK LIVER FATTY ACIDS

TESTING OIL STABILITY

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fish dried in this way, was slow enough for the plumping-up of the outer layers to seriously impede further water penetration.

In all of the samples examined, the drying process seemed to bring about some irreversible hardening of the protein. Attempts were made to discover the cause of this hardening, and the possibility of cross-linkage formation was extensively investigated. The contribution of salt linkages to toughening was recognized. Few, if any, acid-base linkages were formed, but the possibility of amino-carbonyl linkages does exist. The authors also considered the possibilities of sulfide linkages, but they did not obtain any conclusive evidence for these linkages.

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during precooking will result in a greater dilution of the sauce in the can and an objectionable quality of the sauce. Since on the label of the can only the weight of the fish fillets had to be mentioned in Germany, without a description of the way in which these fillets have been prepared before packing, there is always a possibility that through the packing of insufficiently precooked fish the customer receives an underweight product. It is suggested that the product descriptions be altered accordingly.

Changes in the Weight of Canned Herring Fillets during Sterilization and Storage

Weight of Herring Fillets in the Can (g.)	Sauce	Net Weight of the Fish in the Can, (g.)		
		After sterilization	After storage for 3 weeks at 30° to 35° C. (86° to 95° F.)	After storage for 6 weeks at room temperature
Raw Herring Fillets				
140.0	3% salt solution	113.2	106.5	113.0
140.0	Oil	113.2	111.0	109.1
140.0	Normal tomato sauce	115.1	111.5	102.0
140.0	Thinner tomato sauce	109.8	114.5	108.5
200.1	Without sauce	—	161.0	—
Infrared-cooked Herring Fillets				
140.0	3% salt solution	119.5	117.0	117.3
140.0	Oil	121.5	—	119.8
140.0	Normal tomato sauce	118.0	118.0	116.5
140.0	Thinner tomato sauce	121.5	118.0	117.5
186.7	Without sauce	168.2	—	—
194.7	" "	—	155.0	—

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In order to compare the results, all the tests were set up according to established statistical procedures. The statistical analysis shows that the ASTM bomb data correlates fairly well with both the Active Oxygen data and the School Oven data. The ASTM Bomb Method, however, has the advantages of speed, precision and requires a minimum of technical training on the part of the analyst.

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Table 5.--Fatty acid compositions of Pristis cuspidatus liver fats

Reference Unsaponifiables, % Acids	(6) 1 to 2%	(author) 12.5%
Myristic	1.2	1.8
Palmitic	22.9	24.8
Stearic	12.7	14.6
Arachidic	0.1	1.0
Unsaturated		
C_{14}	0.2	0.3
C_{16}	8.2	6.4
C_{18}	28.5	23.7
C_{20}	16.4	18.1
C_{22}	5.2	7.4
C_{24}	4.6	1.9
Average number of double bonds in unsaturated acids		
C_{14}	1.0	1.0
C_{16}	1.0	1.1
C_{18}	1.1	1.2
C_{20}	2.7	1.8
C_{22}	3.7	4.0
C_{24}	5.6	5.5

4.90 FISH OIL -- NUTRITIVE VALUE

Kaneda, T.; Sakai, H.; Ishii, S.; and Arai, K.
Bulletin of the Tokai Regional Fisheries Research Laboratory No. 12, 73 pp. (December 1955) (Tokyo, Japan)
World Fisheries Abstracts 8, 45-46 (July-August 1957)

Studies were made on the calorific value of fish oils and shark liver oils because unsaponifiable matters contained in marine animal oils--particularly in liver oil of some spp. of sharks--are much greater in quantity than in land animal oils. The nutritive value of unsaturated fatty acids is depleted when the double bond in the fatty acids increases; highly unsaturated acids show toxic effects on the growth of animals. If this is actually the case, it might be surmised that to eat sardines in large amounts would be harmful. But highly unsaturated acids are rapidly autoxidized when exposed to air and might not be harmful as long as they were well refined and remained free from autoxidation; toxicity of highly unsaturated acids is caused, not with the unsaturation but by the oxidized products of the unsaturated acids. To confirm this hypothesis, a sample of nonautoxidized highly unsaturated acids extracted from sardine oil was administered to rats who showed no distaste for this diet. From the nutritive point of view, the result was almost as good as with rats fed with oleic acid (control). However, animals receiving a diet containing highly unsaturated acids obtained from the same sardine oil, but autoxidized by atmospheric oxygen, all died after losing weight. On the basis of these findings, it is concluded that highly unsaturated acids contained in fresh fish are not detrimental to animals. To see if this is applicable to other natural unsaturated fatty acids, similar feeding experiments using ethyl ester of acids of linseed oil, were carried out, with the same results. All unsaturated fatty acids become harmful if they are oxidized, even though some of them (e.g., oleic acid) may not be so easily oxidized as others. Of all the oxidized products, such as peroxide, conjugated acids, polymerized products, aldehydes, ketones, etc., only a few are supposed to be highly

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4.91 ASSIMILATION OF DIETARY EICOSENOIC AND ERUCIC ACID ESTERS

Hopkins, C. Y.; Chisholm, Mary J.; Murray, T. K.; and Campbell, J. A. (National Research Council, Ottawa, Canada)
Journal of the American Oil Chemists' Society 34, 505-508 (October 1957)

Saturated acids with 20 or more carbon atoms, when fed to rats, were rejected to a large degree by excretion. Evidence has been reported to show that the absorption of monoenoic acids above C_{18} also diminishes. The present study was made to determine the extent of deposition of the common monounsaturated C_{20} and C_{22} acids when fed as methyl esters to albino rats in comparison with oleic acid.

Experimental.--The basal diet fed to the albino rats contained corn starch, 58 percent; vitamin-free casein, 20 percent; yeast (fat free), 8 percent; cellulose (Alphacel), 5 percent; salt mixture (U. S. P. XIV), 4 percent, fat (when added), 5 percent. The basal diet was almost, but not entirely, fat-free because the starch and the vitamin mixture contained traces of fat. Each rat received 84 I. U. of vitamin A, 84 I. U. of vitamin D, and 0.84 mg. of vitamin E (d-α-tocopherol) in 0.1 ml. of corn oil at weekly intervals.

Fatty acid esters were prepared from natural vegetable oils by fractional distillation of the mixed methyl esters and then by fractional crystallization of the appropriate fractions from acetone at temperatures as low as -45°C. These esters were of high purity.

For the feeding tests, 50 inbred albino rats of the Wistar strain were divided into five groups with each group consisting of five males and five females. All groups received the basal diet. Experimental fats were added to the extent of 5 parts of fat to 95 parts of basal diet to obtain the fat containing diets. The nonfat diet was obtained by adding starch to the basal diet in place of fat. Group 1 received corn oil, group 2 received no fat, group 3 received methyl oleates, group 4 received methyl eicosenoate, and group 5 received methyl erucate. Feed was provided ad libitum for a period of 12 weeks beginning with rats at weaning (30 to 40 grams in weight). The rats were individually penned,

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 ABSTRACTER: Martin Heerdt

4.92 HOW SERIOUS IS THE FOOD FATS PROBLEM?

Page, Irving H. (Chairman, American Heart Association Scientific Council)
The National Provisioner 137, 208-211 (October 5, 1957)

The problem of food fats is so important, not only as it relates to heart disease but also to general nutrition, that we must not rush in with answers that are questionable--as is happening. In trying to solve a problem like this one, our greatest difficulty is that we tend, in our haste, to over-simplify it. The problem is extremely complex, and it is this multi-faceted nature of the disease that confuses people.

Arteriosclerosis simply means there is fat in the blood. Fat is the only insoluble substance the body must deal with. Proteins, minerals, and carbohydrates are soluble in water; whereas fat is not soluble, and the body has the problem of carrying it around.

It does this by combining the fat with protein, forming lipo-proteins. The body makes these lipo-proteins in the intestine for the purpose of transporting an insoluble substance, fat, through the blood stream. Being very large molecules, lipo-proteins are quite unstable and tend to break down.

Blood pressure forces the blood laden with lipo-protein through the wall of the blood vessel. If you have more lipo-protein in your blood stream than normal, some of the lipo-protein is likely to stay in the wall of the blood vessel instead of passing through. When it stays there, this lipo-protein breaks down and liberates insoluble fat in the wall itself.

Insoluble fat within the wall is the beginning of arteriosclerosis. The fat, not being a normal

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 ABSTRACTER: F. Bruce Sanford

6.195 CHANGES INDUCED BY AUTOCLAVING A SOLVENT -- EXTRACTED COTTONSEED MEAL

Conkerton, Edith J.; Martinez, Wilda H.; Mann, G. E.; and Frampton, V. L.
Journal of Agricultural and Food Chemistry 32, 460-463 (June 1957)

Chemical differences between cottonseed meals of known and varied nutritive value were studied by determining the effect of autoclaving a prime-quality, solvent-extracted meal upon its soluble protein fractions. Heat damage incurred during processing affects the protein quality of the meals. The extent of this heat damage will vary, even within a given method of processing. A rapid and reliable method for estimating the amount of heat damage is needed in order to control commerical processing methods, to develop new processing techniques, and to assess the quality of cottonseed meals.

Gross differentiation between good and poor meals has been estimated by nitrogen solubility in 0.02N sodium hydroxide. This method is not sufficiently accurate to demonstrate the extent of heat damage on the quality of the protein. This study was conducted to obtain additional information on the effect of heat on protein in the meals. The following determinations were made on fractions of the original and the autoclaved meals: (1) total nitrogen, (2) nonprotein, nitrogen, (3) total and free gossypol, (4) moisture, (5) phosphorus, (6) sugar, and (7) amino acids.

The original meal was solvent extracted and then autoclaved for two hours. This treatment decreased the nitrogen solubility by 65 to 70 percent, lysine by 40 percent, arginine by 15 percent, sugar by 20 percent, and total gossypol slightly. No effect was apparent on the content of nitrogen, nonprotein nitrogen, or total phosphorus.

Properties of control and autoclaved cottonseed meal and their insoluble fractions are shown in table 1 (see over).

Nitrogenous materials that are soluble at pH 6.5 are not affected by heat, but globulins and glutelins are almost completely denatured. It is not known if this is related to reduction in

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 ABSTRACTER: Neva L. Karrick

NUTRITIVE VALUE OF FISH OILS

FATTY ACID NUTRITION

ROLE OF FAT IN HEART DISEASE

HEAT DAMAGE TO MEALS

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and a record was kept of the amount of food that they ate. At the end of 12 weeks male rats were sacrificed and females were bred and continued on the same diets until their litters were weaned, or for a total feeding period of 20 weeks, after which they were sacrificed.

Extraction of body fat.--Carcasses of the rats in each group were separated into pelt, viscera, and carcass. Each portion of a group then was heated with 10 percent aqueous alkali to release the fat, acidified, and then the fat and fatty acids combined and saponified with alcoholic alkali. The resulting soap solutions were extracted with petroleum ether to remove unsaponifiable matter, and then acidified to recover the total fatty acids.

Body fat characteristics.--A sample of pooled fatty acids from each group was used in the determination of iodine value and equivalent weight. The dienoic, trienoic, and tetraenoic fatty acid content of the body fats was determined by ultraviolet absorption after isomerization. The separate acids from the pelt, the carcass, and the viscera of each group were combined as a group and esterified with methanol. The pelt acids of males on the eicosenoate diet were esterified and distilled separately. These esters were fractionally distilled in a spinning band column at 0.5 mm. pressure. The proportions of C_{16}, C_{18}, C_{20}, and C_{22} acids were estimated from the distillation curves, the weight of the distilled fractions, and the analysis of the fractions.

Results.--Eicosenoic acid that was fed as the methyl ester to the extent of 5 percent of the diet was deposited in a substantial amount in the body fat. Erucic acid, fed in the same way, was deposited in a much smaller amount in the body fat. Neither of these acids appeared to be as readily deposited in the body fat as the linoleic acid of corn oil. Oleic, eicosenoic, and erucic acids (all monounsaturated) were deposited apparently without alteration in chain length or degree of saturation. Conversion of eicosenoate to arachidic or stearic or of erucate to behenic, arachidic, or stearic acids did not appear in any appreciable amount. Conversion of eicosenoate to oleic acid or of erucate to eicosenoic acid likewise did not appear in any appreciable amount. Conversion of eicosenoate to arachidonic acid by the animal did not occur. Diets containing oleate, eicosenoate, and erucate deposited about the same total amount of body fat irrespective of diets.

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toxic while most of them are mildly toxic. An experiment to determine what is most responsible for the toxic effects, was conducted, by separating toxic products from nontoxic ones by means of solvent extraction, chromatography, urea complexes, etc. The results indicated that the fraction which did not form a urea complex was most toxic. Other experiments indicated that the toxic effects were mainly due to the production of peroxide-structure. The peroxide-free products turned out to be nontoxic in the case of autoxidized highly unsaturated acids. Therefore, the most toxic material in autoxidized unsaturated acids is the peroxide produced at the beginning of the autoxidation. Another feeding experiment conducted with oil of salted and dried fish gave a result in which the oil of salted-dried saury (peroxide value 65) indicated toxic effects. The oil of dried herring (peroxide value 14) favored the growth of rats. From the above findings, it may be justifiable to conclude that the nutritive value of oils of salted-dried fish is influenced by the degree of autoxidation, and that if the original oil shows a high iodine number, the nutritive value becomes lower when it is autoxidized.

The studies on the nutritive value of shark liver oils have made it clear that the liver oils of various spp., such as angel shark, ground shark, dog fish, goblin shark, sting ray and thresher shark, showed good effects upon the growth of rats. However, the liver oils of Etmopterus sp. and hammerhead shark were much inferior.

It was found that seborrhea was caused by either oleyl oleate, cetyl oleate, oleyl stearate, octadecyl oleate, or partially hydrogenated products of oleyl oleate. The lipid of the viscera and muscles of rats fed with oleyl oleate had a low saponification number and contained much unsaponifiable matter. Oleyl oleate is presumed to deposit in the tissue and cause seborrhea. The conclusion of these experiments is that in preparation of edible fish oil caution should be taken to prevent its autoxidation. When samples of fish oil were slightly hydrogenated or polymerized and compared with the original oils, the treated oils were found, as anticipated, more nutritious than the unprocessed oil.

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nutritive value induced by heat. Other factors that may affect the nutritive value of meal are destruction of lysine, arginine, and sugars; and apparent liberation of phosphate from organic combinations.

Several fundamental differences exist between the way this meal was heat damaged and the ways damage could occur in commercial processing. Oil and gossypol are present when meal is heated under commercial conditions. Therefore, results might be different in commercially processed meals.

Table 1.--Properties of control and autoclaved cottonseed meal and their insoluble fractions

Sample	Moisture content %	Nitrogen		Nonprotein Nitrogen		Amino acid in protein, %					
		Total[a] %	% of initial	Total[a] %	% of meal nitrogen	Glutamic	Aspartic	Cystine	Lysine	Arginine	Histidine
Whole meal											
Control	6.9	10	..	0.7	7	19.4	9.8	2.1	4.3	11.5	2.4
Autoclaved	7.6	10.3	..	1.0	7	19.6	9.6	1.7	2.7	9.8	2.1
Insoluble, pH 6.5											
Control	6.6	11.8	83	...	..	...	...	...	...	...	...
Autoclaved	5.1	12.3	81	...	..	...	...	...	...	...	...
Insoluble, salt											
Control	7.6	9.0	43	...	..	...	...	...	...	...	...
Autoclaved	4.0	10.5	65	...	..	...	...	...	...	...	...
Insoluble, pH 10.5											
Control	6.3	7.8	25	0.1	1	16.2	10.3	1.7	4.4	8.8	2.2
Autoclaved	7.4	12.4	70	0.1	1	19.6	10.9	1.7	3.2	9.7	2.1

[a] Calculated to dry-weight basis.

4.92

constituent of the blood, acts as a foreign body. The blood vessel, therefore, reacts to it by scarring, just as does any part of the body when you introduce a foreign substance. Then the overlying areas become rough and lead to the formation of a blood clot. When a clot forms, the result is a heart attack, and the accompanying pain is the reaction of the heart to its need for blood. This is the so-called myocardial infarction or "coronary."

You now can see why the argument runs that if you lower the level of blood cholesterol in the sick person, it may well be of some benefit, and if it is good for a sick person, it must be good for a normal person. Is that argument valid? There is no telling at this time because the evidence is not all in.

In answer to the question whether people should or should not change the fat in their diets, the only thing we can say categorically is that, if they want to keep their weight down, reduction in the amount of fat is a good way to do it. If you are a sick person, this again is something else, and experimental low-fat diets may well be in order. If, however, you are a well person, hoping thereby to prevent arteriosclerosis and heart attacks, the only solid advise is that you should not become obese; therefore, you should cut down the amount of fat in your diet and take an adequate amount of exercise. Change in the quality of fat may be important, but this is not by any means certain.

6.19 HIGH-ENERGY CHICKEN FEED

Anonymous
Food Manufacture 32, 350 (July 1, 1957)

A new farming record--producing 1 lb. of chicken with less than 2 lb. of feed--has been achieved at Derbyshire, with a special "high-energy" feed. Getting 1 lb. of chicken with 2 lb. of feed has been regarded as the "four minute mile" of agriculture. It has been achieved in the U. S. under experimental conditions at Illinois University but never before on an ordinary commercial farm.

It is claimed that in large scale trials, the new feed gave a 25% better feed conversion and 9.3% more live weight than the best proprietary feed given to a similar batch of about 2,000 spring chickens. Its production efficiency index was 50% better than that of another well-known proprietary feed.

The high-energy feed was formulated and tested at a research station in Hull, which has been carrying out pioneer work on high-energy rations for some years. The record is the culmination of the long series of research and controlled trials based on the theory that fat and cod liver oil pack more 'punch' per lb. than any other feed ingredient.

The ration which gave these record results can be mixed as follows:

	Parts by weight
White-fish meal (66% protein)	11½
Soya bean meal	7½
Dried yeast	5
Coarse ground wheat	27½

(over)

Reprinted in part

6.81 TECHNIQUE OF PEARL CULTURE

Tranter, D. J. (C.S.I.R.O., Division of Fisheries and Oceanography, Australia)
Fisheries Newsletter (Australia) 16, 11, 25 (September 1957)

Pearls have been cultured for many years in the Japanese pearl oyster, Pinctada martensii. Experiments have been made with Australian species of Pinctada to see if pearls could be cultured in Australia. P. maxima was chosen because its large size offered scope for culturing large pearls, 10 to 15 mm. in diameter, that would compete in the world market. The experiments were carried out at the C.S.I.R.O., Field Station, Thursday Island.

Both "half-pearls" and "graft-pearls" have been cultured. The technique of half-pearl culture is to insert a spherical mother-of-pearl nucleus beneath the mantle of the oyster, where it becomes coated with nacre and cemented to the shell. To prevent its initial extrusion, it either must be placed behind the adductor muscle or affixed to the nacreous shell border. When the pearl is removed, there will be a flaw at the point of attachment, and this must be covered in the jewel setting. Hence the name, "half-pearl."

The technique of graft-pearl culture is to insert the nucleus within the tissues, and to place in contact with it a mantle graft from another oyster. The transplanted mantle tissue grows around the nucleus to form a pearl-sac, and in this new position secretes nacre around the nucleus, just as in its original position it secreted nacre upon the shell surface. The result is a completely spherical pearl.

Since the oysters are difficult to open, they are narcotized beforehand by immersion in a menthol-sea-water solution until the valves remain permanently agape. They then may be treated and returned to running sea water where they will recover in 10 to 15 minutes. There are no harmful after effects.

(over)

ABSTRACTER: Kathryn L. Osterhaug

7.80 CONSUMER ACCEPTANCE METHODOLOGY: ONE VS. TWO SAMPLES

Simone, Marion and Pangborn, Rose Marie (University of California, Davis)
Food Technology 11, 25-29 (September 1957)

Purpose.--A mass-panel consumer survey was made to compare results obtainable by single and paired stimuli techniques. The study was a continuation of efforts to determine the sweetness-acid-flavor relationship in fruit products.

Experimental.--The effect of the addition of citric acid on the acceptability of and the preference for canned cling peaches was determined in a mass panel survey conducted at the California State Fair in September 1956. Diced cling peaches of the Gaume variety that had been packed under rigid control with variation in the amount of sucrose and citric acid were presented to the panel.

Three evaluation methods were used in making the survey: (1) single stimulus, hedonic rating scale, (2) paired stimuli, hedonic rating scale; and (3) paired stimuli, preference. The hedonic scale that was used in methods 1 and 2 was developed by Peryam and Giradot and included nine structured levels ranging from "like extremely," through "neither like nor dislike," to "dislike extremely." In the paired preference method, the participant indicated a preference for sample 1 or sample 2.

The response sheet for each of the three methods included questions such as age group, sex, height, weight, and frequency of use of canned peaches. The three methods were alternated throughout the 12 days that the fair was in operation. If the paired stimuli method was used, a balanced procedure was followed in which six paired-combinations were presented. Care was taken to serve an equal number of reverse order combinations.

(over)

ABSTRACTER: Martin Heerdt

2.01 FRESH FISH 2. CHLOROMYXUM THYRSITES IN VARIOUS SOUTH AFRICAN FISHES

Rowan, M. K.
Annual Report of the Fishing Industry Research Institute, Cape Town, South Africa 9, 7-8 (1955-1956)

Protozoa of the order Myxosporidia are known to occur in the somatic muscles of a number of different fish throughout the world. Their presence is frequently associated with a post mortem breakdown and liquefaction of the muscle tissues.

Gilchrist (1924) and Davies and Beyers (1947) have shown that, among South African fishes, a Myxosporidian (Chloromyxum thyrsites) occurs in the snoek (Thyrsites atun), the hake (Merluccius capensis), and the John Dory (Zeus capensis). Current studies at the Fishing Industry Research Institute reveal that the genus Chloromyxum is found also in the pilchard (Sardinops ocellata) and the maasbanker or horse mackerel (Trachurus trachurus).

A small sample of heavily infected maasbanker, however, showed no sign of the characteristic breakdown of the flesh even after it has been stored for six days in ice. These maasbanker may be host to a different species of Chloromyxum, such as C. quadratum, which was observed in the muscles of the maasbanker and described by Thelohan in 1895. Liquefaction of the muscles of infected maasbanker after death has not been recorded.

Microscopic enumeration of spores.--Elaborate histological methods are needed to obtain detailed morphological studies of Chloromyxum. Simple diagnosis, however, can be made adequately from dried smears of teased-out or disintegrated muscle fibers that have been stained with Loeffler's methylene blue. In dried smears the characteristic spores with four deeply stained polar capsules are unmistakable, and vegetative forms also can be identified. The number of spores per gram of infected tissue can be estimated quickly by the use of the stained dried smear and a modified version

(over)

ABSTRACTER: Martin Heerdt

HIGH-ENERGY BROILER RATION

PEARL CULTURE

COMPARISON OF SENSORY METHODS

PROTOZOA IN FISH

6.81

So far, 100 nuclei have been inserted by each method. Post-operative mortality was of the order of 10 percent for the graft technique and 1 percent for the half-pearl technique.

Of those oysters treated by the graft method, 40 have been recovered so far, and eight of the nuclei were found. Three of these had become noticeably covered with nacre during the nine months.

Of the nuclei inserted for half-pearl culture, 70 percent were retained. Periodic sampling showed that they became cemented to the shell within a month, and completely covered by nacre in three. The earliest nacreous secretions were often discolored, but later these became coated with fine nacre. It is estimated that a half-pearl would reach marketable quality in 9 to 12 months.

This represents the first production of cultured pearls in Australia.

2.01 (Cross Reference: 2.00)

of Tarr's adaptation of the Prescott-Breed method for counting bacteria. Spore counts ranging from tens of thousands to tens of millions per gram of flesh have been obtained by this method.

Liquefaction of the muscles of pilchards was not observed during ordinary storage, but after prolonged storage liquefaction became increasingly evident in pilchards with high spore counts. Portions of pilchards that had two million or more spores per gram collapsed and turned mushy when they were canned and processed. Pilchards with lower spore counts could be canned satisfactorily.

The ultraviolet test for Chloromyxum.--According to Davies and Beyers (1947), Chloromyxum can be detected in hake and John Dory by exposing the fillets to ultraviolet light that has been filtered through Woods glass. Under these conditions affected muscle fibers fluoresce as spots or streaks so that large samples of these two species can be assayed for: (1) distribution of the infection within the tissues, (2) intensity of the infection, and (3) the number of fish infected. Combined microscopic diagnosis and the ultraviolet light assays suggest that the ultraviolet light assay provides primarily a measure of the intensity of the infection.

If hake that showed from five to over eighty fluorescent streaks under ultraviolet light were examined microscopically, the presence of Chloromyxum could be demonstrated in both fluorescent and nonfluorescent samples from 50 percent of the fish. In the remaining 50 percent, spores were discovered only in smears prepared from fluorescent tissue. From the limited number of spore counts made, it appears that the difference may be quantitative as no fluorescence was observed in flesh having less than 70,000 spores per gram. Fifteen John Dory's similarly examined, all contained abundant spores on microscopic examination; but only three showed fluorescence under ultraviolet light. On prolonged storage, fluorescent streaks in affected fish become diffuse and tend to disappear. Ultraviolet light cannot be used successfully to detect infection in brown-fleshed oily fishes, such as pilchards and maasbankers. The proportion of affected fish in four of the five known host species including maasbankers appears to vary from time to time, and in some years anywhere from 40 to 90 percent of the population may be involved.

6.19

	Parts by weight
Barley meal	8½
Ground oats	10
Maize meal	22½
Minerals	2½
Stabilized cod liver oil high-energy mix*	5
Total	100

Plus: antibiotics at 100 gm. per ton for 3 weeks and 25 gm. per ton to slaughter; coccidiostat; and antisalmonella drug.

* The stabilized high-energy mix consists of 1 part super solvitax cod liver oil and 3 parts vegetable oil plus anti-oxidants.

7.80

Four samples of canned cling peaches that varied in apparent sweetness showed similarity in the results obtained. The degree of difference that appeared, however, was a criterion of choosing one over the other. The results of these surveys were not highly significant, and the observations and indications were based mainly on trends. A paired preference technique appeared more precise in establishing significant preferences among a series of samples with relatively small acceptability gradients than did the hedonic rating scale with either single or paired stimuli.

The application of the hedonic rating scale to a mass consumer survey such as the one described above appears to have some restrictions. The number of ballots discarded owing to the confusion of the participants was greatest for the paired hedonic rating method, moderate for the single hedonic method, and least for the paired preference method. The apparent precision of the single stimuli over the paired hedonic stimuli may account for the confusion factor. Higher rates of precision were obtained with all samples rated by the single stimuli method than were obtained with the paired hedonic method.

In a heterogeneous population such as the one surveyed, the time and supervision required to explain the scale makes this method of questionable value. Since canned peaches are a highly acceptable food to begin with, the rating scale used was not the most precise tool for obtaining a rank preference.

Variations in response owing to age and sex differences were apparent among the three presentation methods and within any one of the methods. Less consistency in discrimination and higher acceptability ratings were present among the youngest and the oldest age groups. Females displayed a wider range and higher level of rating than did males.

0.5 QUANTITATIVE VARIATIONS IN THE BACTERIAL FLORA OF FLATFISH

Liston, J.
J. gen. Microbiol. 15, 305-314 (1956)
Food Science Abstracts 29, 127 (April 1957)

Bacterial counts made, at intervals over a period of 27 months, on skin, gut, and gill samples of freshly caught skate and lemon sole showed maxima that tended to occur about 2 months after the spring and autumn plankton outbursts. Counts for skin and gill samples (but not gut samples) were, in general, higher on an agar medium made with sea water than on a horse-heart agar medium made with tap water. Incubation at 0° C. usually gave somewhat lower counts than incubation at 20° C. Counts at 37° C. were never more than 3% of those at 20° C.

0.5 A NEW SPECIES OF BACTERIUM WHICH PRODUCES LARGE AMOUNTS OF HISTAMINE ON FISH MEATS, FOUND IN SPOILED FRESH FISH

Kimata, M. and Kawai, A.
Mem. Res. Inst. Food Sci., Kyoto Univ., No. 7, pp. 12-17 (1954)
Food Science Abstracts 29, 128 (April 1957)

0.5 ON THE BACTERIA CAUSING SPOILAGE OF FRESH FISH, ESPECIALLY ON THEIR ACTIVITY WHICH CAN PRODUCE HISTAMINE

Kimata, M. and Tanaka, M.
Mem. Res. Inst. Food Sci., Kyoto Univ., No. 7, pp. 12-17 (1954)
Food Science Abstracts 29, 128 (April 1957)

1.24 FISH OILS VII. THE PIGMENTS OF PILCHARD OIL

Bailey, B. E.
Journal of the Fisheries Research Board of Canada 4, 55-58 (April 1938)

(Abstract of this article appears under 8.59 page 15 - July 1957)

1.24 FISH OILS VIII. THE APPROXIMATE COMPOSITION OF THE FATTY ACIDS OF THE OIL OF PILCHARDS (SARDINOPS CAERULEA)

Brocklesby,, H. N. and Harding, K. F.
Journal of the Fisheries Research Board of Canada 4, 59-62 (April 1938)

(Abstract of this article appears under 4.13 page 9 - August 1957)

2.1121 THE GRANTON TRAWL PART 8: THE RUNNING GEAR

Garner, John
World Fishing 6, 49-51 (November 1957)

Running gear includes all of the wire ropes that are used for heaving. These include the gilson, derrick gilson, after gilson, tackle, messenger wire, towing block, and the midship derrick. Included also are the snottler, hook ropes, after slip-hook, the gallows, and the bag ropes.

2.1121 ON THE RESISTANCE OF VARIOUS COD ENDS FIXED IN A STREAM--IV.

Taniguchi, Takeo
Bulletin of the Japanese Society of Scientific Fisheries 22, No. 12, 727-729 (1957) (English synopsis, table, and figures)

The hydrodynamic resistance of pyramid type cod ends with different total area of webbing was measured experimentally. The results were compared with the theoretical value. The total resistance of the cod end changes rather slightly as compared with the variation of the length of cod end.

2.1125 STUDY ON THE FISHING CAPACITIES OF PURSE SEINES. I. ON DISTRIBUTION OF DAILY CATCHES OF PURSE SEINES

Iitaka, Yunosuke (Department of Fisheries, Kyoto University, Maizuru, Japan)
Bulletin of the Japanese Society of Scientific Fisheries 22, No. 8, 455-458 (1956) (In English)

As the first step in the series of studies, the frequency distribution of daily catches by a purse seine was investigated.

2.1125 DANISH-SEINING EXPLORATIONS IN NEWFOUNDLAND AND CAPE BRETON AREAS

Stewart, T. N.
Fisheries Research Board of Canada Bulletin No. 108, 26 pp. (1956) (Ottawa)

(Abstract of this article appears under 2.1121 page 1 - April 1957)

2.3 ROCK LOBSTER 3. STERILIZATION OF SEA WATER BY ULTRAVIOLET LIGHT

Rowan, M. K.
Annual Report of the Fishing Industry Research Institute, Cape Town, South Africa 9, 18 (1955-1956)

Ultraviolet irradiation achieved a 92 to 100 percent kill of Clostridium welchii organisms in dock water collected in sterile vessels.

2.3 APPARATUS FOR PEELING AND SEPARATING SHRIMP

Lapeyre, F. S.; et al.
U. S. Patent 2,785,435, 9 pp. (March 19, 1957)

The present invention relates to apparatus for peeling and separating shrimp and more particularly relates to a machine for the accurate and complete separation of the hulls or shells from shrimp meat in an automatic and simple operation.

2.9 STUDIES ON THE RADIO ELEMENTS IN THE CONTAMINATING RADIOACTIVE FISH--III. ON SKIPJACKS CAUGHT AT THE PACIFIC OCEAN IN 1956 (PART 2) ON THE PRESENCE OF Cd^{113m}

Shirai, Kazuo; Saiki, Masamichi; and Ohno, Susumu
Bulletin of the Japanese Society of Scientific Fisheries 22, No. 10, 651-653 (1957) (English synopsis, tables, and figures)

Group II, separated directly from the raw ashes of the liver or the pyloric caeca of skipjacks, (Katsuwonus pelamis), or from the radioactive fraction obtained by ion-exchange resin, was fractionated further into each member. A considerable activity was found in the Cd-fraction in both cases.

2.9 ANIMAL PHYLA KNOWN TO CONTAIN POISONOUS MARINE ANIMALS

Halstead, Bruce W. (Coll. of Med. Evangelists, Loma Linda, California)
Publ. Am. Assoc. Advance Sci. No. 44, 9-27 (1954) (Pub. 1956)
Chemical Abstracts 51, 8312 (June 10, 1957)

Mainly a biol. and medical outline and review, with chem. and toxicological data on the venoms of different sea species. 139 references.

3.234 BULK-FREEZING OF FISH

Heen, Eirik; Karsti, Olaf; and Bagge-Lund, Einar
FAO Fisheries Bulletin 10, 89-98 (April-June 1957)

(Abstract of this article appears under 2.118 page 3 - November 1957)

3.234 EMISSIVITY OF ICE, SNOW, AND FROZEN GROUND

Dunkle, R. V.; Gier, J. T.; and Bevans, J. T. (University of California, Berkeley)
Refrigerating Engineering 65, 33-35, 89 (April 1957)

The measurement of the emissivity of snow, ice, and frozen ground was undertaken as a phase of a research program under the auspices of the Snow, Ice and Permafrost Research Establishment of the U. S. Army Corps of Engineers. The need for such information in environmental heat transfer studies is readily apparent and the results are of importance in many other fields of Engineering.

3.238 REFRIGERATION OF FISH PART 4. PREPARATION, FREEZING, AND COLD STORAGE OF FISH, SHELLFISH, AND PRECOOKED FISHERY PRODUCTS

Dassow, John A.; Pottinger, S. R.; and Holston, John
Fishery Leaflet 430 (1956)

(Abstract of this article appears under 3.23 page 7 - December 1956)

3.238 PROPERTIES OF PACKAGING FILMS

Anonymous
Modern Packaging Encyclopedia Issue for 1957, 30, No. 3A, (Between pp. 136 and 137) (November 1956)

3.2381 FROZEN FISHERY PRODUCTS STORAGE LIFE EXTENDED BY GLUCOSE-SALT BRINE GLAZE

Anonymous
Commercial Fisheries Review 19, 5 (July 1957)

Studies on a carbohydrate-base glazing liquid have shown such materials may become of potentially great value in the prevention of freezer-burn (desiccation) and rusting (oxidative discoloration) in frozen fishery products during extended storage. The moisture-retaining property of the carbohydrate film glaze is considered to be responsible for the protection of the stored food product. These studies were conducted by the Bureau of Commercial Fisheries' Seattle Technological Laboratory.

3.2382 FACTORS AFFECTING QUALITY OF PREPACKAGED MEAT II. COLOR STUDIES. A EFFECT OF PACKAGE CHARACTERISTICS UPON COLOR OF PRODUCT

Rikert, John A.; Ball, C. Olin; and Stier, Elizabeth A. (Rutgers University, New Brunswick, New Jersey)
Food Technology 11, 520-525 (October 1957)

Cellophane-acetate-pliofilm laminate was shown to be one of the best packaging materials for maintaining good color in cut and in ground samples of lamb (7 to 12 days' storage). Vinyldene copolymer was the best for packaging lean ground beef to retain color and cellulose acetate the best for fat ground beef. Cellophane-pliofilm laminate proved best for color retention in ground lean and fat pork.

3.2382 NEW PACK BOOSTS MULLET

Wright, C. E. (Jacksonville, Florida)
Food Engineering 29, 71 (November 1957)

Iced mullet are scaled, headed, washed, and packaged in sealed bags. The sealed bags are exposed to 205° F. water for 5 seconds and are shrunk to a skin tight fit. Packaged mullet are blast frozen at -30° F. and packed in 15- to 25-pound size master cartons for distribution.

3.332 FISH CANNING 2. FISH TAG RECOVERY

Rowan, M. K.
Annual Report of the Fishing Industry Research Institute, Cape Town, South Africa 9, 14-15 (1955-1956)

Tests were made to measure the effectiveness of the removal of belly tags from fish intended for canning. Sixty-six pilchards were tagged in the belly cavities while in rigor mortis. Ten tags were recovered in the belly cavities of the cut fish. Four were found in the container used to carry pilchards to the sorting table. Eight were found in the flume into which the pilchards tumble after evisceration. The forty-four missing tags were presumed lost either in the flume or in the pipes carrying the offal to the dump.

3.332 FISH CANNING 3. SPICE ESSENCE IN CANNED PILCHARDS IN TOMATO

Dreosti, G. M. and Edwardes, C. A.
Annual Report of the Fishing Industry Research Institute, Cape Town, South Africa 9, 15 (1955-1956)

Different spice essences were added to separate portions of tomato puree in amounts of 1 ounce of spice per 12.5 to 50 gallons of puree. Two ounces of spiced puree then were added to each 16 ounces of pilchards canned in A-1 tall cans, and after several weeks the cans were examined. An attractive flavor was given to the sauce and to the fish by two locally manufactured spice essences and one American spice essence.

3.336 ROCK LOBSTER 4. REDUCTION OF STORAGE ODOR AND FLAVOR BY CITRIC ACID

van der Merwe, R. P.
Annual Report of the Fishing Industry Research Institute, Cape Town, South Africa 9, 18 (1955-1956)

Canned rock lobster may accumulate peculiar and unattractive odors in storage at room temperature. Lobster meat dipped for 5 or 15 minutes in 0.3 percent citric acid solution and canned, had respectively, a very slight storage odor and no storage odor, a normal texture and a somewhat stringy texture, a pH of 6.4, a normal color, and struvite in all cans. Lobster meat, dipped for 5 or 15 minutes in 3.0 percent citric acid solution and canned, had a pH of 6.0 and 5.8, respectively, a definite acid odor and flavor, a stringy texture, struvite in all cans, and a slight but distinct darkening of the flesh. Internal can corrosion was not evident.

3.336 ROCK LOBSTER 5. EXCESS OF SODIUM HEXAMETAPHOSPHATE

van der Merwe, R. P.
Annual Report of the Fishing Industry Research Institute, Cape Town, South Africa 9, 18 (1955-1956)

Rock lobster was experimentally canned with none, ½, 2½ and 5 percent of dry sodium hexametaphosphate to learn the effect of excessive amounts of this compound. After 8 months at room temperature, control cans contained normal amounts of struvite; whereas none was present in treated canned lobster. Canned lobster treated with 2½ and 5 percent of the phosphate was dark brown in color and all cans were severely corroded inside.

3.4 FISH SAUSAGE I. THE PROPERTIES OF CASING

Shimizu, Wataru; Ueno, Saburo; and Fujita, Masao (Kyoto Univ.)
Kyoto Daigaku Shokuryo Kagaku Kenkyujo Hokoku No. 19, 34-43 (1957)
Chemical Abstracts 51, 9029 (June 25, 1957)

Ryphan, a hydrochlorinated gum, and Kurehalon, a poly (vinylidene chloride) product, were compared with each other as the casing materials for fish sausage. Resistance to heating, water permeability, bacterial infectability, and dyeing ability were examd. by comparison.

3.4 FISH SAUSAGE II. CHEMICAL COMPOSITIONS OF COMMERCIAL FISH SAUSAGE AND THE EFFECTS OF STORAGE

Shimizu, Wataru; Ueno, Saburo; Hîbiki, Shigeyuki; Jujita, Masao; Shimizu, Yutaka; Endo, Kinji; Shimizu, Ushio; Ikeuchi, Tsuneo; Takagi, Ichiro; Terashima, Hiroyoshi; and Nakagoshi, Akiko
Kyoto Daigaku Shokuryo Kagaku Kenkyujo Hokoku No. 19, 44-51 (1957)
Chemical Abstracts 51, 9030 (June 25, 1957)

Total acid, pH, volatile-base N, and no. of bacteria together with appearance were described for a great many samples of com. fish sausage. Preserving them at 38° caused NH_3 evolution acid formation, softening, and other deteriorations.

3.9 FERMENTED FISH SAUCE

Velankar, N. K.
J. Sci. Industr. Res. (India) 16A, 3, 141 (1957)
Food Manufacture 32, 339 (July 1, 1957)

Local sardines were washed in tap water and 100 lb. mixed with 35 lb. of salt, placed in a wooden barrel and covered with a further 50 lb. of the washed fish mixed with salt in the proportion 2:1. The total formol and volatile nitrogen contents of the product increased progressively during a five-month period. About 50 lb. of a clear, amber-colored liquid, having no fishy or unpleasant odor, were obtained.

3.61 EVAPORATION AND DEHYDRATION EQUIPMENT

Anonymous
Food Manufacture 29, 520-525 (November 1, 1957)

Other topics discussed are: Multiplication of effects, thermo compression, film evaporators, plate evaporators, heat pump evaporators, vacuum pans, driers for solid foods, drying coarse or granular materials, vacuum tray dryers, and radiant heat dryers.

4.12 XI. FATTY ACIDS AND UNSAPONIFIABLE MATTER OF SEA ANEMONE

Toyama, Yoshiyuki, Tanaka, Tatsuo; and Maeda, Takeo
Mem. Fac. Eng., Nagoya Univ. 7, 156-60 (1955)
Chemical Abstracts 51, 4737 (March 25, 1957)

Fatty acids and unsaponifiable matter were sepd. from the oil extd. from sea anemones (Anthopleura japonica, A. stella, and A pacifica). The compn. of the fatty acids (as Me esters): C_{14} acid 1.3, C_{16} acid 10.9, C_{18} acid and higher acid 3.7, unsatd. acids (as Me esters) C_{16} (-H, 6.5) acid 28.5, C_{22} (-H, 8.4) acid 20.7%, where -H, 2 denotes an av. of 1 double bond, -H, 4.2 double bonds, etc. The unsaponifiable matter contains 44.7% of sterol. The sterol components consist mainly of sterol of the Δ 5-series. β-Sitosterol is the main component. The unsaponifiable components other than sterol included cetyl acl. and an unsatd. alc. of the oleyl series.

4.12 FATTY OILS OF STICHOPUS JAPONICUS, ASTRICLYPEUS MANNI, CLYPEASTER JAPONICUS, AND GORGONOCEPHALUS CARYI

Toyama, Yoshiyuki and Takagi, Toru
Mem. Fac. Eng., Nagoya Univ. 7, 151-5 (1955)
Chemical Abstracts 51, 4737 (March 25, 1957)

Fatty oils from S. japonicus (I), A. manni (II), C. japonicus (III) and G. caryi (IV), were examd. Polyethenoid acids from S. japonicus and C. japonicus were estd. by ultraviolet absorption measurements of the alkali-isomerized fatty acids. The oils obtained from IV had a much lower I no. than the oil obtained from the same species in a previous study. The sterol components of I contain sterol of the Δ^7-series, while those of II and III consist chiefly of cholesterol, and those of IV consist mainly of sterol of the Δ^5-series. The sterol content of the unsaponifiable matter of I is very small, 7.45%. This is characteristic of the oils from the Holothurioidea. Other than sterol the oil of I probably contains alcs. of the batyl and selachyl series.

4.15 UREA ADDUCTS OF FATTY ACIDS VIII. COMPONENTS FATTY ACIDS OF INDIAN SHARK LIVER OILS

Mehta, T. N.; Rao, B. Y.; and Sihota, G. S. (Nagpur Univ.)
J. Indian Chem. Soc., Ind. New 19, 1-11 (1956)
Chemical Abstracts 50, 17480 (November 25, 1956)

4.15 LIVER OIL OF LAEMONEMA MOROSUM. III. THE COMPONENTS OF LOW-BOILING FRACTIONS OF UNSAPONIFIABLE MATTER

Komori, Saburo; Agawa, Toshio; Hirao, Yoshio; and Kumata, Koji (Osaka Univ.)
Abura Kagaku 5, 284-7 (1956)
Chemical Abstracts 51, 12512 (August 25, 1957)

The oil of L. Morosum, a gadid fish, (n_D^{20} 1.4712, acid no. 4.2, sapon. no. 130.6, I no. 108.4, unsaponifiable matter 34.9%) was saponified to obtain the unsaponifiable matter, which was fractionated by distg. at 2-mm. Hg. pressure after acetylation. Each fraction was examd. for the yield, sapon. no., and I no., and in cases necessary was refractionated. This unsaponifiable matter consisted of about 10% hexadechyl alc., small amts. of octadecanol and eicosanol, about 50% 11-docosen-1-ol, a considerable amt. of 9-eicosenol, and a smaller amt. of 9-octadecenol. Cholesterol also was identified.

6.194 THE NUTRITIVE VALUE OF HERRING MEALS 3. THE EFFECTS OF HEAT TREATMENT AND STORAGE TEMPERATURE

Biely, J.; March, B. E.; and Tarr, H. L. A.
Poultry Science 34, 1274-1279 (November 1955)

(Abstract of this article appears under 6.190 page 13 - July 1956)

6.194 THE VITAMINS I.

Robinson, F. A.
Food Manufacture 31, 63-65 (February 1956)

(Abstract of this article appears under 5.0 page 13 - August 1956)

LIST OF PUBLICATIONS REGULARLY ABSTRACTED

Analyst
Analytical Chemistry
Archives of Biochemistry and Biophysics
Biochemical Journal
Bulletin of the Faculty of Fisheries, Hokkaido University
Bulletin of the Japanese Society of Scientific Fisheries
California Fish and Game
Canadian Fisherman
Canadian Journal of Chemistry
Canadian Journal of Technology
Canner and Freezer
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Processing
Chemistry and Industry
Commercial Fisheries Review
Drug and Cosmetic Industry
FAO Fisheries Bulletin
Federation Proceedings
Feed Bag
Feedstuffs
Fisheries Newsletter (Australia)
Fish. Res. Bd. Can., Prog. Repts. Atlantic Coast Stas.
Fish. Res. Bd. Can., Prog. Repts. Pacific Coast Stas.
Fishing Gazette
Food Engineering
Food Manufacture
Food Packer
Food Preservation Quarterly
Food Processing
Food Research
Food Science Abstracts
Food Technology
Frosted Food Field
Gourmet
Industrial and Engineering Chemistry
Industrial Refrigeration
Institutions
Journal of Agricultural and Food Chemistry
Journal of Applied Chemistry
Journal of Biological Chemistry
Journal of Nutrition
Journal of Organic Chemistry
Journal of the American Chemical Society
Journal of the American Dietetic Association
Journal of the American Oil Chemists' Society
Journal of the Association of Official Agricultural Chemists
Journal of the Chemical Society (London)
Journal of the Fisheries Research Board of Canada
Journal of the Science of Food and Agriculture
Maine Coast Fisherman
Modern Packaging
Modern Refrigeration
National Fisherman
National Provisioner
Nature
Nutrition Reviews
Pacific Fisherman
Pan American Fisherman
Poultry Science
Practical Home Economics
Progressive Fish-Culturist
Quick Frozen Foods
Refrigerating Engineering
Report of the Food Investigation Board (Great Britain)
Science
Southern Fisherman
Trade News (Fisheries Department, Canada)
Western Fisheries
World Fisheries Abstracts
World Fishing

Articles chosen for abstracting or inclusion as bibliographical references are those deemed of interest to the commercial fisheries and to fishery technological laboratories. Occasionally pertinent articles from sources other than the above listed publications are included. Biological papers are generally omitted.

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Editorial Clerk (Typist)--Gladys K. Chandler

7.51 DETERMINATION OF PROTEIN NITROGEN IN FISH MEAL

Ricotta, Biagia M. C. and Sara, Raimondo
Conserve e deriv. agrumari (Palermo) 20, 194-8 (1956)
Chemical Abstracts 51, 7608 (May 25, 1957)

Total N (II) is detd. by nesslerization. Nonprotein N (II) is detd. after pptn. with 10% phospbomolybdic acid and treating the soln. with Stein-Moore reagent (cf. C. A. 43, 2266g, 2267f) to det. the amino N (III). Nucleic acids are extd. with 10% Cl_3C-COOH and their N (IV) is detd. by nesslerization II = I - (III + IV).

7.51 ACID REQUIREMENTS OF THE KJELDAHL DIGESTION

Bradstreet, R. B. (The Bradstreet Laboratories, Inc., Cranford, New Jersey)
Analytical Chemistry 29, 944-947 (June 1957)

Acid indices have been calculated from which optimum conditions of digestion may be determined. Data are presented showing that loss of nitrogen occurs as the digest approaches a solid state. Sodium sulfate requires a higher ratio of acid to salt than an equivalent amount of potassium sulfate or potassium sulfate--sodium thiosulfate mixture, thus making this salt unsuitable for use with refractory compounds.

8.43 THE DISTRIBUTION OF EXCESSIVE WATER

Anonymous
Nutrition Reviews 14, 251-252 (August 1956)

The cells of the body acted as perfect osmometers and water was distributed between cellular and extracellular compartments in accordance with the distribution of osmotically active particles.

8.43 A RAPID METHOD FOR THE DETERMINATION OF MOISTURE CONTENT IN FISH MEAT II. RELATION BETWEEN ERROR OF ESTIMATION AND FAT CONTENT

Tsuchiya, Yasuhiko and Sato, Yoshio (Tohoku University, Sendai, Japan)
The Tohoku Journal of Agricultural Research 7, 273-276 (January 1957)

In part I. the senior author dehydrated fish flesh with an aqueous solution of methanol and measured the specific gravity of the resulting solution as a means of assaying moisture in fish. The method proved to be applicable for determining the moisture content of fatty fish meat. The margin of error was ± 1.9 percent.

8.53 SIZE AND FAT CONTENT OF PILCHARDS

Stander, G. H.
Annual Report of the Fishing Industry Research Institute, Cape Town, South Africa 9, 21 (1955-1956)

This study reports further work on the relation between pilchard size and fat content for headed and gutted raw pilchards and for headed, gutted, and precooked (10 minutes at 212° F.) pilchards. As found previously, small pilchards either raw or cooked have a higher fat content than large pilchards either raw or cooked.

8.53 NUTRITIVE VALUE OF SOME BOMBAY FISH III. PHOSPHOLIPIDES IN FISH

Joshi, Soonoo and Magar, N. G.
J. Univ. Bombay 23B, No. 5, 27-33 (1955)
Chemical Abstracts 51, 11608 (August 10, 1957)

Data are presented for the phospholipide content of the brain and muscle of 22 varieties of fish by using the methods suggested by Johnson, et al. The compds. detd. were: lecithin, choline, sphingomyelin, cephalin, and ester cholesterol. Muscle varied in its lipide content.

9.2 TUNA

Anonymous
Pacific Fisherman (Yearbook number 1956) 121-148 (January 25, 1956)

(Abstract of this article appears under 1.10 page 1 - (October 1956)

9.2 FISHERIES OF THE UNITED STATES AND ALASKA, 1956 A PRELIMINARY REVIEW

Power, E. A.
Fishery Leaflet 393 (Revised April 1957) United States Department of the Interior, Fish and Wildlife Service, Washington 25, D. C.)

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4.62 FOOD AND FEED ANTIOXIDANTS

Anonymous
Journal of Agricultural and Food Chemistry 4, 667-668 (August 1956)

(Abstract of this article appears under 6.14 page 17 - March 1957)

4.83 SELECTIVE ACIDOLYSIS, A METHOD FOR THE SEGREGATION OF DRYING AND SEMI-DRYING OILS

Lansom, H. J.
Journal American Oil Chemists' Society 33, 68-71 (February 1956)

(Abstract of this article appears under 4.29 page 11 - November 1956)

4.85 PROSPECTS OF UTILIZING LITHIUM SALTS OF FATTY ACIDS FROM FISH OILS IN LUBRICATING GREASES

Anonymous
Commercial Fisheries Review 18, 13 (September 1956)

6.130 PROTEIN LOSSES INCURRED DURING HYDRAULIC CONVEYANCE OF FISH WASTE

Wisniewski, R.
Przem. Spozyw. 10, 67-69 (1956)
Food Science Abstracts 28, 461 (October 1956)

6.132 A FERMENTATION PROCESS FOR THE PRODUCTION OF QUALITY FISH MEAL

Pillai, V. Krishna (Central Marine Fisheries Research Sta., Mandapam Camp)
Current Sci. (India) 25, 293-4 (1956)
Chemical Abstracts 51, 4591 (March 25, 1957)

An improved quality of fish meal was produced by mixing the meal with skim milk (1 oz. of milk to 6 lb. flesh) and H_2O and allowing the mixt. to ferment at 30 to 35° for about 4 hrs. with const. agitation. The material after fermentation was pressed and sun-dried. A considerable reduction in fat content occurred as a result of this process with a concomitant increase in protein. Also more H_2O-sol. protein was retained by this process than by cooking and then drying.

6.133 MEASURING, RECORDING, AND CONTROLLING THE DEGREE OF UNSATURATION OF OILS

Goldsmith, Kurt; Worstall, Vivian D.; and Heselgrave, Peter W. (Lever Brothers Co.)
U. S. 2,766,265 (October 9, 1956)
Chemical Abstracts 51, 744 (January 10, 1957)

6.32 A STUDY ON THE MUCILAGE OF GLOIOPELTIS FURCATA. I. ON THE INORGANIC COMPONENTS

Mita, Kiyo
Bulletin of the Japaneses Society of Scientific Fisheries 22, No. 9, 558-560 (1956) (English abstracts and table)

Out of inorganic components of Gloiopeltis furcata a species of seaweed, and its mucilage extracted in room temperature, major elements were detected by the ordinary method, and minute elements by arc spectrum analysis. The minute elements contained in the seaweed were Ti, Cu, Mn. Ashed material of the mucilage was 16.1% against the weight of dried material with important inorganic components comprising Na, Mg, Si, and S.

6.33 ON THE STRUCTURE OF AGAR FROM GELIDIUM CARTILAGINIUM

O'Neill, A. N. and Stewart, D. K. R.
Canadian Journal of Chemistry 34, 1701-1703 (December 1956)

Agar from Gelidium cartilaginium has been analyzed for D-galactose, 3, 6-anhydro-L-galactose, and sulphate. From these analyses and a study of the products of mercaptolysis it is suggested that agar from this source be represented as a chain of alternating D-galactose and 3, 6-anhydro-L-galactose residues with a half-ester sulphate on about every 10th galactose unit.

8.6 TABLES OF THE CHEMICAL COMPOSITION OF FISH I. VITAMINS

Kühnau, J.
Arch. Fischereiwiss 7, 28 pp. (1956)
Food Science Abstracts 29, 36 (February 1956)

Data are tabulated, showing the contents in various fish and their organs of the following vitamins: A, B_1, B_2, nicotinic acid, pantothenic acid, biotin, B_{12}, folic acid, ascorbic acid, D, and E. There is also a systematic survey of the fish in which the vitamin contents were estimated.

8.60 TOCOPHEROL AND VITAMIN A CONTENT OF SOME MARINE BLUBBER OILS

Heller, Christine A. (Cornell Univ., Ithaca, New York)
Dissertation Abstr. 16, 226-7 (1956)
Chemical Abstracts 50, 8233 (June 10, 1956)

8.61 VITAMIN A AND CAROTENOIDS IN CERTAIN INVERTEBRATES. IV. MOLLUSCA: LORICATA, LAMELLIBRANCHIATA, AND GASTROPODA. V. MOLLUSCA: CEPHALOPODA

Fisher, L. R.; Kon, S. K.; and Thompson, S. Y. (Univ. Reading, England)
Chemical Abstracts 50, 9631 (July 10, 1956)

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